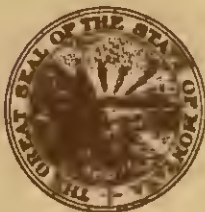


Water Resources Survey



*Hill County,
Montana*

RECORDS
MANAGEMENT
WRS COPY

Part I:

HISTORY OF LAND AND WATER
USE ON IRRIGATED AREAS

and

Part II:

MAPS SHOWING IRRIGATED AREAS
IN COLORS DESIGNATING THE
SOURCES OF SUPPLY

Published by

STATE WATER CONSERVATION BOARD

Helena, Montana — June, 1967



WATER RESOURCES SURVEY

HILL COUNTY MONTANA

Part I

History of Land and Water Use on Irrigated Areas



Published by
STATE WATER CONSERVATION BOARD
Helena, Montana

June, 1967

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June, 1967

Honorable Tim M. Babcock
Governor of Montana
Capitol Building
Helena, Montana

Dear Governor Babcock:

Submitted herewith is a consolidated report on a survey of Water Resources for Hill County, Montana.

The report is divided into two parts: Part I consists of history of land and water use, irrigated lands, water rights, etc., and Part II contains the township maps in the County showing in colors the lands irrigated from each source or canal system.

Work has been completed and reports are now available for the following counties: Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Deer Lodge, Fallon, Flathead, Gallatin, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Missoula, Musselshell, Park, Pondera, Powder River, Powell, Ravalli, Rosebud, Silver Bow, Stillwater, Sweet Grass, Teton, Treasure, Wibaux, Wheatland, and Yellowstone.

The office files contain minute descriptions and details of each individual water right and land use, which are too voluminous to be included herein. These office files are available for inspection to those who are interested.

The historical data on water rights contained in these reports can never become obsolete. If new information is added from time to time as new developments occur, the records can always be kept current and up-to-date.

Respectfully submitted,

A. D. McDERMOTT, Director
State Water Conservation Board

ACKNOWLEDGMENTS

A survey and study of water resources involves many phases of both field and office work in order to gather the necessary data to make the information complete and comprehensive. Appreciation of the splendid cooperation of various agencies and individuals who gave their time and assistance in aiding us in gathering the data for the preparation of this report is hereby acknowledged.

HILL COUNTY OFFICIALS

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Herschel Fox, Commissioner

Fritz Naber, Commissioner

Russell E. Blom, Clerk and Recorder

Mrs. Susie Schlatter, Clerk of District Court

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FOREWORD

SURFACE WATER

Our concern over surface water rights in Montana is nearly a century old. When the first Territorial Legislature, meeting in Bannack, adopted the common law of England on January 11, 1865, the Territory's legal profession assumed that it had adopted the Doctrine of Riparian Rights. This doctrine has evolved in England and in the eastern United States where the annual rainfall is generally more than twenty inches. It gave the owners of land bordering a stream the right to have that stream flow past their land undiminished in quantity and unaltered in quality and to use it for household and livestock purposes. The law restricted the use of water to riparian owners and forbade them to reduce appreciably the stream flow, but the early miners and ranchers in Montana favored the Doctrine of Prior Appropriation which permitted diversion and diminution of the streams. Consequently, the next day the legislature enacted another law which permitted diversion by both riparian and non-riparian owners. Whether or not this action provided Montana with one or two definitions of water rights was not settled until 1921 when the Montana Supreme Court in the *Mettler vs. Ames Realty* case declared the Doctrine of Prior Appropriation to be the valid Montana water right law. "Our conclusion," it said, "is that the common law doctrine of riparian rights has never prevailed in Montana since the enactment of the Bannack Statutes in 1865 and that it is unsuited to the conditions here. . . ."

The appropriation right which originated in California was used by the forty-niners to divert water from the streams to placer mine gold. They applied to the water the same rules that they applied to their mining claims—first in time, first in right and limitation of the right by beneficial use. Those who came to Montana gulches brought with them these rules, applying them to agriculture as well as to mining.

The main points of consideration under the Doctrine of Prior Appropriation are:

1. The use of water may be acquired by both riparian and non-riparian landowners.
2. It allows diversion of water regardless of the reduction of the water supply in the stream.
3. The value of the right is determined by the priority of the appropriation; i.e., first in time is first in right.
4. The right is limited to the use of the water. Stream waters in Montana are the property of the State and the appropriator acquires only a right to their use. Moreover, this use must be beneficial.
5. A right to the use of water is considered property only in the sense that it can be bought or sold; its owner may not be deprived of it except by due process of law.

The State Legislature has provided methods for the acquisition, determination of priority and administration of the right. No right may be acquired on a stream without diversion of water and its application to a beneficial use. On unadjudicated streams, the Statutes stipulate that the diversion must be preceded by posting a notice at a point of intended diversion and by filing a copy of

it within 20 days in the county clerk's office of the county in which the appropriation is being made. Construction of the means of diversion must begin within 40 days of the posting and continue with reasonable diligence to completion. However, the Montana Supreme Court has ruled that an appropriator who fails to comply with the Statutes may still acquire a right merely by digging a ditch and putting the water to beneficial use.

To obtain a water right on an adjudicated stream one must petition the District Court having jurisdiction over the stream for permission to make an appropriation. If the other appropriators do not object, the court gives its consent and issues a supplementary decree granting the right subject to the rights of the prior appropriators.

Montana laws do not require water users to file official records of the completion of their appropriations; therefore, it becomes advisable as soon as the demand for the waters of a stream becomes greater than its supply, to determine the rights and priorities of each user by means of an adjudication of water right suit. This action may be initiated by one or more of the appropriators who may make all the other claimants parties to the suit. The Judge of the District Court then examines all of the claims and issues a decree establishing priority of the right of each water user and the amount of water he is entitled to use. The court decree becomes in effect the deed of the appropriator to his water right.

Whenever scarcity of water in an adjudicated stream requires an allocation of the supply according to the priority of rights, the Judge, upon petition of the owners of at least 15 percent of the water rights affected, must appoint a water commissioner to distribute the water. Chapter No. 231, Montana Session Laws 1963, Senate Bill 55 amended Section 89-1001 R.C.M. 1947, to provide that a water commissioner be appointed to distribute decreed water rights by application of fifteen percent (15%) of the owners of the water rights affected, or, under certain circumstances at the discretion of the Judge of the District Court— **"provided that when petitioners make proper showing they are not able to obtain the application of the owners of at least fifteen percent (15%) of the water rights affected, and they are unable to obtain the water to which they are entitled, the Judge of the District Court having jurisdiction may, in his discretion, appoint a water commissioner."** After the Commissioner has been appointed the Judge gives his instructions on how the water is to be apportioned and distributed in accordance with the full terms of the decree.

The recording of appropriations in local courthouses provides an incomplete record of the water rights on unadjudicated streams. In fact, the county records often bear little relation to the existing situation. Since the law places no restrictions on the number or extent of the filings which may be made on an unadjudicated stream, the total amount of water claimed is frequently many times the available flow. There are numerous examples of streams becoming over appropriated. Once, six appropriators each claimed all the water in Lyman Creek near Bozeman. Before the adjudication of claims to the waters of Prickly Pear Creek, 68 parties claimed thirty times its average flow of about 50 cfs. Today, the Big Hole River with an average flow of about 1,000 cfs. has filings totaling 173,912 cfs. One is unable to distinguish in the county courthouses the perfected rights from the unperfected ones since the law requires no official recording of the completion of an appropriation. Recognition by the courts of unrecorded appropriations adds to the incompleteness of these records. To further complicate the situation, appropriators have used different names for the same stream in their filings. In Montana, many of the streams flow through several counties; consequently, water right filings on these inter-county streams are found distributed in two or more county court-

houses. Anyone desirous of determining appropriations on a certain river or creek finds it difficult and expensive to examine records in several places. In addition, the records are sometimes scattered because the original nine counties of 1865 have now increased to 56. As the original counties have been divided and subdivided, the water right filings have frequently not been transcribed from the records of one county to the other. Thus, a record of an early appropriation in what is at present Powell County may be found in the courthouse of the original Deer Lodge County.

It can readily be seen that this system of recording offers little protection to rights in the use of water until they are determined by adjudication. In other words, an appropriator does not gain clear title to his water right until after adjudication, and then the title may not be clear because the Montana system of determining rights is also faulty. In the first place, adjudications are costly, sometimes extremely costly when they are prolonged for years. It is estimated that litigation over the Beaverhead River, which has lasted more than twenty years, has cost the residents of the valley nearly one-half million dollars. In the second place, unless the court seeks the advice of a competent irrigation engineer, the adjudication may be based upon inaccurate evidence; in the third place, if some claimant has been inadvertently left out of the action, the decree is not final and may be reopened for consideration by the aggrieved party. Another difficulty arises in determining the ownership of a water right when land under an adjudicated stream becomes subdivided in later years and the water is not apportioned to the land by deed or otherwise. There is no provision made by law requiring the recording of specific water right ownership on deeds and abstracts.

The Legislative Session of 1957 passed Chapter 114 providing for the policing of water released from storage to be transmitted through a natural stream bed to the place of use. The owner of the storage must petition the court for the right to have the water policed from the storage reservoir to his place of use. If there are no objections, the court may issue the right and appoint a water commissioner to distribute the water in accordance therewith. This law applies only to unadjudicated streams.

Administration of water on adjudicated streams is done by the District Court, but it has its drawbacks. The appointment of a water commissioner is often delayed until the shortage of water is acute and the court frequently finds it difficult to obtain a competent appointee for so temporary a position. The present administration of adjudicated streams which cross the county boundaries of judicial districts create problems. Many of the water decrees stipulate head gates and measuring devices for proper water distribution, but in many instances the stipulation is not enforced, causing disagreement among water users.

Since a water right is considered property and may be bought and sold, the nature of water requires certain limitations in its use. One of the major difficulties encountered after an adjudication of a stream is the failure of the District Court to have control over the transfer of water rights from their designated place of use. The sale and leasing of water is becoming a common practice on many adjudicated streams and has created serious complications. By changing the water use to a different location, many of the remaining rights along the stream are disrupted, resulting in a complete breakdown of the purpose intended by the adjudication. Legal action necessary to correct this situation must be initiated by the injured parties as it is their responsibility and not that of the court.

At one time or another all of the Western Reclamation States have used similar methods of local regulation of water rights. Now all of them, except Montana, have more or less abandoned these prac-

tics and replaced them by a system of centralized state control such as the one adopted by the State of Wyoming. The key characteristics of the Wyoming system are the registration of both the initiation and completion of an appropriation in the State Engineer's Office, the determination of rights and administration by a State Board of Control headed by the State Engineer. These methods give the Wyoming water users title to the use of water as definite and defensible as those which they have to their land.

When Montana began to negotiate the Yellowstone River Compact with Wyoming and North Dakota in 1939, the need for some definite information concerning our water and its use became apparent. The Legislature in 1939 passed a bill (Ch. 185) authorizing the collection of data pertaining to our uses of water and it is under this authority that the Water Resources Survey is being carried on. The purpose of this survey is six fold: (1) to catalogue by counties in the office of the State Engineer, all recorded, appropriated, and decreed water rights including the use rights as they are found; (2) to map the lands upon which the water is being used; (3) to provide the public with pertinent water right information on any stream, thereby assisting in any transaction involving water; (4) to help State and Federal agencies in pertinent matters; (5) to eliminate unnecessary court action in water right disputes; and (6) to have a complete inventory of our perfected water rights in case of need to defend these rights against the encroachments of lower states, or Wyoming or Canada.

GROUND WATER

Ground water and surface water are often intimately related. In fact, it is difficult in some cases to consider one without the other. In times of heavy precipitation and surface runoff, water seeps below the land surface to recharge underground reservoirs which, in turn, discharge ground water to streams and maintains their flow during dry periods. The amount of water stored underground is far greater than the amount of surface water in Montana, and, without seepage from underground sources, it is probable that nearly all the streams in the state would cease to flow during dry periods.

It is believed that Montana's ground water resources are vast and only partly developed. Yet, this resource is now undergoing accelerated development as the need for its use increases and economical energy for pumping becomes available. Continued rapid development without some regulation of its use would cause a depletion of ground water in areas where the recharge is less than the withdrawal. Experience in other states has shown that once excessive use of ground water in a specific area has started, it is nearly impossible to stop, and may result in painful economic readjustments for the inhabitants of the affected area.

Practical steps aimed at conserving ground water resources as well as correcting related deficiencies in surface water laws became necessary in Montana. Prior to the Legislative Session of 1961, there was no legal method of appropriating ground water. Proposed ground water codes were introduced and rejected in four biennial sessions of the Montana Legislative Assembly—1951, 1953, 1955, and 1959.

In 1961, during the 37th Legislative Session, a bill was introduced and passed creating a Ground Water Code in Montana (Chapter 237, Revised Codes of Montana, 1961). This bill became effective as a law on January 1, 1962, with the State Engineer of Montana designated as "Administrator" to carry out provisions of the Act. However, the 1965 Legislature abolished the office of the State Engineer and transferred his duties to the State Water Conservation Board, effective July 1, 1965. Therefore, the State Water Conservation Board became the "Administrator" of this Act.

Some of the important provisions contained in Montana's Ground Water Law are:

Section 1. DEFINITIONS OR REGULATIONS AS USED IN THE ACT.

(a) "Ground Water" means any fresh water under the surface of the land including the water under the bed of any stream, lake, reservoir, or other body of surface water. Fresh water shall be deemed to be the water fit for domestic, livestock, or agricultural use. The Administrator, after a notice of hearing, is authorized to fix definite standards for determining fresh water in any controlled ground water area or sub-area of the State.

(b) "Aquifer" means any underground geological structure or formation which is capable of yielding water or is capable of recharge.

(c) "Well" means any artificial opening or excavation in the ground, however made, by which ground water can be obtained or through which it flows under natural pressures or is artificially withdrawn.

(d) "Beneficial use" means any economically or socially justifiable withdrawal or utilizations of water.

(e) "Person" means any natural person, association, partnership, corporation, municipality, irrigation district, the State of Montana, or any political sub-division or agency thereof, and the United States or any agency thereof.

(f) "Administrator" means the Water Conservation Board of the State of Montana.

(g) "Ground Water area" means an area which as nearly as known facts permit, may be designated so as to enclose a single distinct body of ground water, which shall be described horizontally by surface description in all cases and which may be limited vertically by describing known geological formations, should conditions dictate this to be desirable. For purpose of administration, large ground water areas may be divided into convenient administrative units known as "sub-areas."

Section 2. RIGHT TO USE.

Rights to surface water where the date of appropriation precedes January 1, 1962, shall take priority over all prior or subsequent ground water rights. The application of ground water to a beneficial use prior to January 1, 1962, is hereby recognized as a water right. Beneficial use shall be the extent and limit of the appropriative right. As to appropriations of ground water completed on and after January 1, 1962, any and all rights must be based upon the filing provisions hereinafter set forth, and as between all appropriators of surface or ground water on and after January 1, 1962, the first in time is first in right.

Any ground water put to beneficial use after January 1, 1962 **must** be filed with the County Clerk and Recorder in the county where the ground water is withdrawn in order to establish a right to use of the water.

Montana's Ground Water Code now provides for three different types of forms available for filing water rights depending upon the nature of the ground water development. The old Form No. 4 became invalid after January 1, 1966.

Form No. 1 **"Notice of Appropriation of Ground Water"**—shall require answers to such questions as (1) the name and address of the appropriator; (2) the beneficial use for which the appropriation is made, including a description of the lands to be benefited if for irrigation; (3) the rate of use in gallons per minute of ground water claimed; (4) the annual period (inclusive dates) of intended use; (5) the probable or intended date of first beneficial use; (6) the probable or intended date of commencement and completion of the well or wells; (7) the location, type, size, and depth of the well or wells contemplated; (8) the probable or estimated depth of the water table or artesian aquifer; (9) the name, address, and license number of the driller engaged; and (10) such other similar information as may be useful in carrying out the policy of this Act. This form is optional, but it has an advantage in that after filing the Notice of Appropriation, a person has 90 days in which to commence actual excavation and diligently prosecute construction of the well. Otherwise, failure to file the Notice of Appropriation deprives the appropriator of his right to relate the date of the appropriation back upon filing the Notice of Completion. (Form No. 2).

Form No. 2 **"Notice of Completion of Ground Water by Means of Well"**—this form shall require answers to the same sort of questions as required by Form No. 1 (Notice of Appropriation of Ground Water), except that for the most part it shall inquire into accomplished facts concerning the well or means of withdrawal, including (a) information as to the static level of water in the casing or the shut-in pressure if the well flows naturally; (b) the capacity of the well in gallons per minute by pumping or natural flow; (c) the approximate drawdown or pumping level of the well; (d) the approximate surface elevation at the well head; (e) the casing record of the well; (f) the drilling log showing the character and thickness of all formations penetrated; (g) the depth to which the well is drilled; and similar information.

It shall be the responsibility of the driller of each well to fill out the Form No. 2, "Notice of Completion of Ground Water by Means of a Well," for the appropriator, and the latter shall be responsible for its filing.

Form No. 3 **"Notice of Completion of Ground Water Appropriation Without a Well"**—is for the benefit of persons obtaining (or desiring to obtain) ground water without a well, such as by sub-irrigation or other natural processes so as to enable such persons to describe the means of using ground water; to estimate the amount of water so used; and requiring such other information pertinent to this particular type of ground water use.

Montana's Ground Water Code, as amended by the 1965 Legislature, provides for a period of four (4) years after January 1, 1962 for filing on vested ground water rights (all ground water used prior to January 1, 1962 from water wells, developed springs, drain ditches, sub-irrigation, etc.). Therefore, the deadline was December 31, 1965. A person did not lose his vested ground water rights by failure to file within the four-year period although, in the event of a future ground water dispute, he may be called upon to prove his rights in court. If a person files now on ground water developed prior to January 1, 1962, his date of priority becomes the date of filing, rather than the date when the water was first used.

It shall be recognized that all persons who have filed a Water Well Log Form as provided for under Section 1 and 2 of Chapter 58, Session Laws of Montana, 1957, shall be considered as having complied with the requirements of this Act.

It is important to note that the ground water law states, "UNTIL A NOTICE OF COMPLETION (form No. 2 or No. 3) IS FILED WITH RESPECT TO **ANY** USE OF GROUND WATER INSTITUTED **AFTER** JANUARY 1, 1962, **NO** RIGHT TO THAT USE OF WATER SHALL BE RECOGNIZED."

Copies of the forms used in filing on ground water are available in the County Clerk and Recorder's office in each of Montana's 56 counties. It shall be the duty of the County Clerk in every instance to file the original copy for the county records; transmit the second copy to the Administrator (Water Conservation Board); and the third copy to the Montana Bureau of Mines and Geology; and the fourth copy to be retained by the appropriator (person making the filing).

Accurate records and the amount of water available for future use are essential in the administration and investigation of water resources. In areas where the water supply becomes critical, the ground water law provides that the administrator may define the boundaries of the aquifer and employ inspectors to enforce rules and regulations regarding withdrawals for the purpose of safeguarding the water supply and the appropriators (see the wording of the law for establishing a "controlled area").

The filing of water right records in a central office under control of a responsible State agency provides the only efficient means for the orderly development and preservation of our water supplies and it protects all of Montana's use—on both ground and surface water.

METHOD OF SURVEY

Water resources data contained in Part I and Part II of this report are obtained from courthouse records in conjunction with individual contacts with landowners. A survey of this type involves extensive detailed work in both the office and field to compile a comprehensive inventory of water rights as they apply to land and other uses.

The material of foremost importance used in conducting the survey is taken from the files of the county courthouse and the data required includes: landownership, water right records (decrees and appropriations), articles of incorporation of ditch companies and any other legal papers concerning the distribution and use of water. Deed records of landownership are reviewed and abstracts are checked for water right information when available.

Aerial photography is used by the survey to assure accuracy in mapping the land areas of water use and all the other detailed information which appears on the final colored township maps in Part II. Section and township locations are determined by the photogrammetric systems, based on government land office survey plate, plane-table surveys, county maps and by "on-the-spot" location during the field survey. Noted on the photographs are the locations of each irrigation system, with the irrigated and irrigable land areas defined. All the information compiled on the aerial photo is transferred and drawn onto a final base map by means of aerial projection. From the base map, color separation maps are made and may include three to ten overlay separation plates, depending on the number of irrigation systems within the township.

Field forms are prepared for each land owner showing the name of the owner and operator, photo index number, a plat defining the ownership boundary, type of irrigation system, source of water supply and the total acreage irrigated and irrigable under each. All of the appropriated and decreed water rights that apply to each ownership are listed on the field forms with the description of intended place of use. During the field survey, all water rights listed on the field form are verified with the landowner. Whenever any doubt or complication exists in the use of a water right, deed records of the land are checked to determine the absolute right and use.

So far as known, this is the first survey of its kind ever attempted in the United States. The value of the work has become well substantiated in the counties completed to date by giving Montana its first accurate and verified information concerning its water rights and their use. New development of land for irrigation purposes by State and Federal agencies is not within the scope of this report. The facts presented are found at the time of completion of each survey and provide the items and figures from which a detailed analysis of water and land use can be made.

The historical data contained in these reports can never become obsolete. If new information is added from time to time as new developments occur, the records can always be kept current and up-to-date.

Complete data obtained from this survey cannot be included in this report as it would make the text too voluminous. However, if one should desire detailed information about any particular water right, lands irrigated, or the number and amount of water rights diverting from any particular stream, such information may be obtained by writing the State Water Conservation Board in Helena.

Every effort is being made to ensure accuracy of the data collected rather than to speed up the work which might invite errors.

WATER RESOURCES SURVEY

Hill County, Montana

PART I

History of Land and Water Use
On Irrigated Areas

Published by
STATE WATER CONSERVATION BOARD
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HISTORY AND ORGANIZATION

Hill County, located in north central Montana, was named after James J. Hill, builder of the Great Northern Railway.

The county was created on September 28, 1912 and included all of the northwestern part of what was originally Chouteau County.

One of the earliest developments in the settling of the Hill County area was the establishment of Fort Assiniboine. In 1878 Congress passed a bill establishing a military reserve 69 miles west of Fort Benton to control the restless Indian tribes on the great northern reservation. The site selected was a location six miles southwest of the present town of Havre and named Fort Assiniboine.

The next step in the development and settlement of Hill County was the building of the Great Northern Railway through that region in 1887. James J. Hill, the founder, received a land grant from the government to connect the Montana Central from Great Falls to St. Paul, Minnesota with the Manitoba line, which had rails as far west as Minot, North Dakota. The grant consisted of 75 feet of land on either side of the railroad bed. Additional grants of land were provided for one station along the line every ten miles. The first engine of the Great Northern Railway rolled into Bull Hooks Siding (later known as Havre) on October 31, 1887.

Some of the old-time settlers of Hill County and the town of Havre were Simon Pepin, James Auld, Ed Broadwater, F. A. Buttrey, Walter Brown, and George Herron.

Simon Pepin of Havre was one of the early pioneers of Montana. He was well known throughout the State and adjoining territory as an industrious freighter, a successful rancher and stock raiser, and a capable and resourceful businessman. While he was working for the Diamond Freighting Company, he started his own cattle business, which became one of the largest in the State. Simon Pepin's home ranch was located two miles from Havre on the north side of the Milk River.

Ed Broadwater came to Montana and was first employed as a bookkeeper at the post trader store at Fort Assiniboine, a job he held for ten years. In 1891 he moved to Havre and opened a general store in partnership with Simon Pepin. Broadwater became Havre's first mayor in 1892; and in addition to his business enterprises, he owned thousands of acres of grazing and farm land in the Hill County area.

George Herron was one of the early ranchers and old-time cowboys in the Havre area. His father, Frank, was employed at Fort Assiniboine for several years. During the time his father worked at the fort, young George rode the range as a cowboy taking care of his father's cattle. It was at this time that George Herron met and made friends with many of the early-day cowboys. When the country was opened for homesteading, his mother was given the first choice in selecting land; she filed on a block of land just north of the fort. The Herron's ran a dairy for many years and supplied the fort, as well as the city of Havre, with milk.

Walter Brown came to the Montana territory in 1882 and first worked as a carpenter for the Northern Pacific Railway. In 1885 he became engaged in sheep raising and ran sheep on the ranges of Shonkin, the Teton, and in later years, on the Indian lands that were open for settlement in the

vicinity of Box Elder. For more than 40 years, Walter Brown operated a large ranch raising sheep, cattle, and horses. He was one of the first to introduce strip-farming methods to the early-day homesteaders. In 1934, Brown sold his ranch near Box Elder to the U. S. Government which was included in the Rocky Boy Indian Reservation.

Another early-day settler in the Hill County area was James Auld. Auld began his career as a cowboy for the N-bar-N ranch near Hinsdale in 1887. That same year he brought his family and settled on a claim of 320 acres near the station of Toledo, seven miles east of the present townsite of Havre. Most of his neighbors were Indians, and both he and Mrs. Auld became well acquainted with the redskins who lived in that area. While at Toledo, he lived in a section house for five years and at one time was one of the oldest employees for the Great Northern Railway between Minot, North Dakota and Great Falls, Montana. He and Bill Swanton formed a ranch partnership and ran about 500 head of cows in their cattle operation. In 1891 Auld built the first livery stable in Havre at the site of what is now the Buttrey's store location.

Mr. and Mrs. F. A. Buttrey came to Havre in 1902 and opened the first store where the Havre Daily News office now stands. This store was destroyed by fire in 1904; in the same year he built the first wing of the present Buttrey store. Buttrey was a powerful and progressive force in the development of this northern Montana area. He had the first radio station, KFBB, in Montana in his Havre store, which was later moved to Great Falls. Some of Buttrey's other firsts in accomplishments included the first auto retail service in Hill County, the first to install automatic fire sprinklers, the first to have a fashion show, and the first merchant to have fresh fruit and vegetables shipped in by railroad carload.

A great rush of settlers came to Hill County when Fort Assiniboine was abandoned as a military post and a large area was thrown open to settlers under the Homestead Act.

In summarizing the history of Hill County, it would not be complete without some mention of the early-day cattlemen and cattle drives. L. K. Devlin bought and loaded 5,000 two-year-old heifers and 200 bulls in northern Iowa and southern Minnesota for Ed Broadwater. They were shipped by rail to Devil's Lake, North Dakota, then driven overland to Havre along the same route of the Great Northern Railway in the fall of 1886. Simon Pepin had charge of the herd and was assisted by Dave Adams, Frank Bigman, and Clem Sailor. The cattle were put out on the range in the Bearpaw Mountains that fall, and in the spring of '87 when Devlin made a roundup, he found only 1,550 head had survived the severe winter of that year.

Another cattleman, William Swanton, helped trail 6,000 head of steers from Augusta in the Sun River area to the Milk River range near Chinook in 1887. The route taken for the cattle drive was east to Great Falls then northeast following the Missouri River to Fort Benton; from Fort Benton the drive continued northeast to Big Sandy and Havre, then down the Milk River to the range near Chinook. These cattle were owned by Bielenberg and Kohrs, and the foreman was D. J. Hogan.

One of the last large herds of cattle brought into Hill County by trailing was by the Y. T. outfit which was located twelve miles south of Havre. Jim McCoy trailed 300 head from Miles City for them in 1894. The route taken was from Miles City via Wolf Point to Glasgow and up the Milk River to Havre. The Y. T. outfit was later owned by Ed Redwing. Two other well-known cattlemen in Hill County having large cattle ranches were Robert Felton and Thomas J. Connolly.

Other important places and events to mention in this summary of Hill County history are the creation of Beaver Creek Park and Rocky Boy Indian Reservation and the construction of Fresno Dam.

Beaver Creek Park was established in 1912 following the opening of the military reserve (Fort Assiniboine) by President Taft in 1911. L. K. Devlin, James Holland, Sr., and E. T. Broadwater were men most instrumental in the creation of Beaver Creek State Park. The park was located twelve miles southwest of Havre and consists of an area one mile wide and eighteen miles long that follows along the course of Beaver Creek.

In 1916 a section of the former military reserve in the Bearpaw Mountains was set aside as the Rocky Boy Indian Reservation and exists under that name today. The Indians on this reservation are descendants of the Chippewa and Cree Indian tribes who originally came from the Red Lake area in Minnesota. These Indians were nomads; and without a treaty or home, some faced starvation when the Fort Assiniboine reserve was abandoned. Friends of the Indians persuaded the Indian Bureau to set aside a part of the military reserve as a home for the wandering Chippewa and Cree tribes. At the present time there are about 400 full-bloods on the reservation.

The Indians on the Rocky Boy Reservation hold an annual sun dance each year which lasts one week and includes other Indian tribes as participants as well as the Chippewa and Cree. To the Indians the sun dance represents a ceremony of purification and thanks.

In 1904 Canada decided to divert water from the Milk River for use in Canada and threatened the water supply along the Milk River Valley in Montana. A treaty was negotiated between Canada and the United States in 1909 dealing with the apportionment of water in the St. Mary and Milk Rivers for Montana and Alberta and Saskatchewan, Canada. It was not until 1931 that a serious situation occurred which eventually led to a plan of water storage to alleviate severe crop damage caused by water shortage in the Milk River. Fresno Dam, located about twelve miles northwest of Havre on the Milk River, was constructed in 1936 climaxing thirty years of negotiations with Canada. Fresno Dam cost \$930,804 and was constructed as a water conservation and flood control project.

Prior to 1910 the Hill County area was occupied almost exclusively by ranchers engaged in the business of raising cattle, sheep and horses. The influx of settlers since that time has transformed the large ranch ranges into a comparatively well settled farming region with the principal crops being spring and winter wheat. Typical of the soil common in this part of the state is a silt loam with an abundance of organic matter. From this type of soil comes astonishing yields and unexcelled quality in wheat and other small grains. Today, the principal industry in the county is farming with some dairying and stock raising.

Havre, the county seat with a population of 10,700 people, is not only the largest town in Hill County but in northern Montana. Havre was actually developed with the building of the St. Paul, Minneapolis, and Manitoba Railway which connected with the Montana Central in 1887. In 1889 these lines were formed into the Great Northern Railway system and the eventual building of a line to Great Falls. Havre became the division point for the railroads, headquarters for the western extension for the Pacific coast, and a stock shipping center for the area. Bull Hooks Siding was the first name given for the town of Havre. The railroad company did not like the name of Bull Hooks

Siding and decided to change it and name it after Simon Pepin, a well-known pioneer of the region. However, Mr. Pepin suggested that they name it after his old home town, Havre, France, and the railroad consented.

Some of the other towns and smaller communities in Hill County are Hingham, Rudyard, Gilford, Inverness, Kremlin, Box Elder, Gold Stone, Simpson, and Laredo.

Transportation facilities in Hill County consist of the Great Northern Railway and U. S. Highway #2 and 87. The main line of the Great Northern Railroad runs through the county about midway between its north and south boundaries. The Havre-Butte division of the Great Northern runs in a southwesterly direction from Havre to Great Falls, Helena, and Butte.

U. S. Highway #2 traverses the county east and west parallel to the Great Northern Railway. U. S. Highway #87 follows a route southwest from Havre to Great Falls. A municipal airport is maintained at Havre and is located four miles west on U. S. Highway #2. Several of the other small towns in the county along the highline have suitable small air strips.

Hill County covers an area of 2,946 square miles and at the last census in 1960 had a population of 18,653.

CLIMATE

Hill County, one of the tier of Montana counties adjoining the U. S. Canadian Boundary and almost midway between Montana's Eastern and Western Borders, has a quite varied topography even though it is not nearly as mountainous as most of the State to the west and south. Elevations range from about 2,400 feet above sea level where the Milk River enters Blaine County to the east, to nearly 7,000 feet on Bearpaw Mountain south of Havre. Much of the area away from the Milk River Valley bottom is fairly hilly, with a considerable complex between hills and valleys. As in most of Montana, these topographical features play a large, almost controlling, part in climate variations from place to place. Most of the county drains roughly southeastward. Sage Creek and the Milk River are the primary system, but there are several streams flowing roughly northward from the Bearpaw Mountains. About half the county is drained through Big Sandy Creek which joins the Milk River a few miles west of Havre.

Situated well away from the Continental Divide (Havre is about 160 miles from the divide ridge at its nearest point), the climate of Hill County is classifiable as "continental" most of the time. However, being in the transition area between the actual east slopes of the Rockies and the "pure" continental climates a few hundred miles to the east, weather patterns several times a year (mainly winter season) closely follow those of the east slopes. In fact, cold season "chinooks" are fairly common, and may last for days at a time, but they don't develop the strength or persistence commonly observed to the west nearer to the mountain range itself. Winter cold waves occur several times a season, and may occur from late October to early April. The characteristic cold wave begins with relatively warm weather for the season (temperatures most often in the 40°-50° range), followed by rapid cooling to zero or below as cold Arctic air moves southward over the county accompanied by snow and brisk winds. However, most cold waves end in a few days, usually with "chinook" type wind and warming.

These cold waves in modern times with modern roads, communications, and equipment, do not pose the problems they did a half century or more ago, but to the unwary or unprepared they still can be dangerous, particularly when temperatures cool to -25° or even colder, as they sometimes do during the winter season.

Summers generally are warm and pleasant, with most rain coming from afternoon showers or thundershowers. Though the highest temperatures ever observed in the county have been in the 110° range, this extreme is rare, and only about 15 to 20 days a year will warm to as high as 90° or higher. The average July maximum over most of the county is about 85° . Oppressive combinations of heat and humidity may occur, but infrequently and seldom for more than a couple of days at a time. Afternoon relative humidity averages 30 to 40 percent in July and August over most of the county.

Precipitation varies considerably across the county, but most of the valley or relatively flat areas have averaged from 11 to 12 inches over a period generally of about 30 years. Larger amounts fall on the Bearpaw Mountains, and the Rocky Boy 15-year 18.43-inch average indicates that up to 30 inches, or even more, may fall on the peaks in the southeast corner of the county; available records of snowfall indicate a fairly uniform 35 to 40 inches a year average over most of the county, with the primary exception of the Bearpaw Mountains where snowfall may exceed 100 inches.

Freeze-free seasons may vary considerably; possibly even more than one might expect. Latitude and elevation changes toward the Canadian Border are important here, showing at Havre a 32° freeze-free season from May 9 to September 23 (138 days), and at Simpson 6NW (near the border) only 101 days from May 30 to September 7. It is likely that freeze-free seasons for most of the county (except Milk River below Fresno Reservoir) are 10 to 15 days shorter than at Havre.

Stormy weather of several kinds occurs at times; cold waves and thundershowers were mentioned above. Strong winds may accompany either of these types, and some strength often occurs with "chinooks," particularly over the more "open" parts of the county. Wind speeds in exposed areas have been known to cause damage to property of several kinds, and unofficial reports have placed an occasional peak speed at more than 80 m.p.h. Summer thunderstorms sometimes produce damaging hail; very few years pass without some crop damage somewhere in the county. Hail damage, however, seldom covers large areas, but even though the total area may be small, individual fields may sustain appreciable crop losses. Tornadoes are rare, and the few reported over the years invariably have been small. Rains heavy enough to cause flooding don't occur very often, but sometimes a late winter accumulation of snow on frozen ground can cause rivers to overflow. This problem, about one year in 10 or 15, occurs in late March or early April, if at all. When snow runoff and rainfall combine during this period, flooding along the Milk River may be troublesome, but fortunately the combination only has a return period of something more than 20 to 25 years.

A table of summarized data follows:

Precipitation

	Yearly Average	Growing Season Average	Percent Falling in Growing Season	Wettest Year	Driest Year
Fort Assiniboine .....1917-1965	11.25	8.56	76	19.07-1927	6.81-1961
Gilford .....1959-1965	10.76	8.43	78	15.57-1965	7.90-1960
Havre .....1880-1965	11.89*	8.61*	72	25.67-1884	6.76-1905
Hingham .....1951-1965	10.88	8.86	81	15.53-1954	6.19-1952
Kremlin .....1951-1965	10.88	8.83	81	14.92-1954	7.05-1952
Simpson .....1931-1965	10.20*	8.16*	80	14.95-1933	5.86-1961
Rocky Boy .....1951-1965	18.43	13.82	75	27.84-1964	13.13-1960

*1931-1960

Temperature

	Highest of Record	Lowest of Record	January Average	July Average	Annual Average
Fort Assiniboine .....1917-1965	111	-48	14.4*	70.0*	42.3*
Gilford .....1959-1965	110	-33	16.9	68.8	43.1
Havre .....1879-1965	111	-57	13.9*	70.0*	42.1*
Simpson .....1931-1965	109	-52	10.7†	69.1†	40.6†

*1931-1960

†1932-1960

SOILS

The profile of the soils in Hill County can best be described as comprising four separate categories; these are glacial, alluvial, terrace, and mountain, with glacial soil being the most predominant. Local rock formations furnish the material for soils found in a given area. The physiography, drainage, and geologic history influence the manner in which these materials were deposited and account for many of the differences found in soils. Soil depth, texture and acidity or alkalinity are directly related, within limits, to the materials from which the soil is formed.

The variations in soils result from the alteration of geologic material either in place or transported, also by climate and living organisms, especially vegetation. The length of time these forces have been active and the topography or lay of the land also contribute to the soil variations. Topography is particularly influential in creating visible soil differences over short distances, often within a few feet.

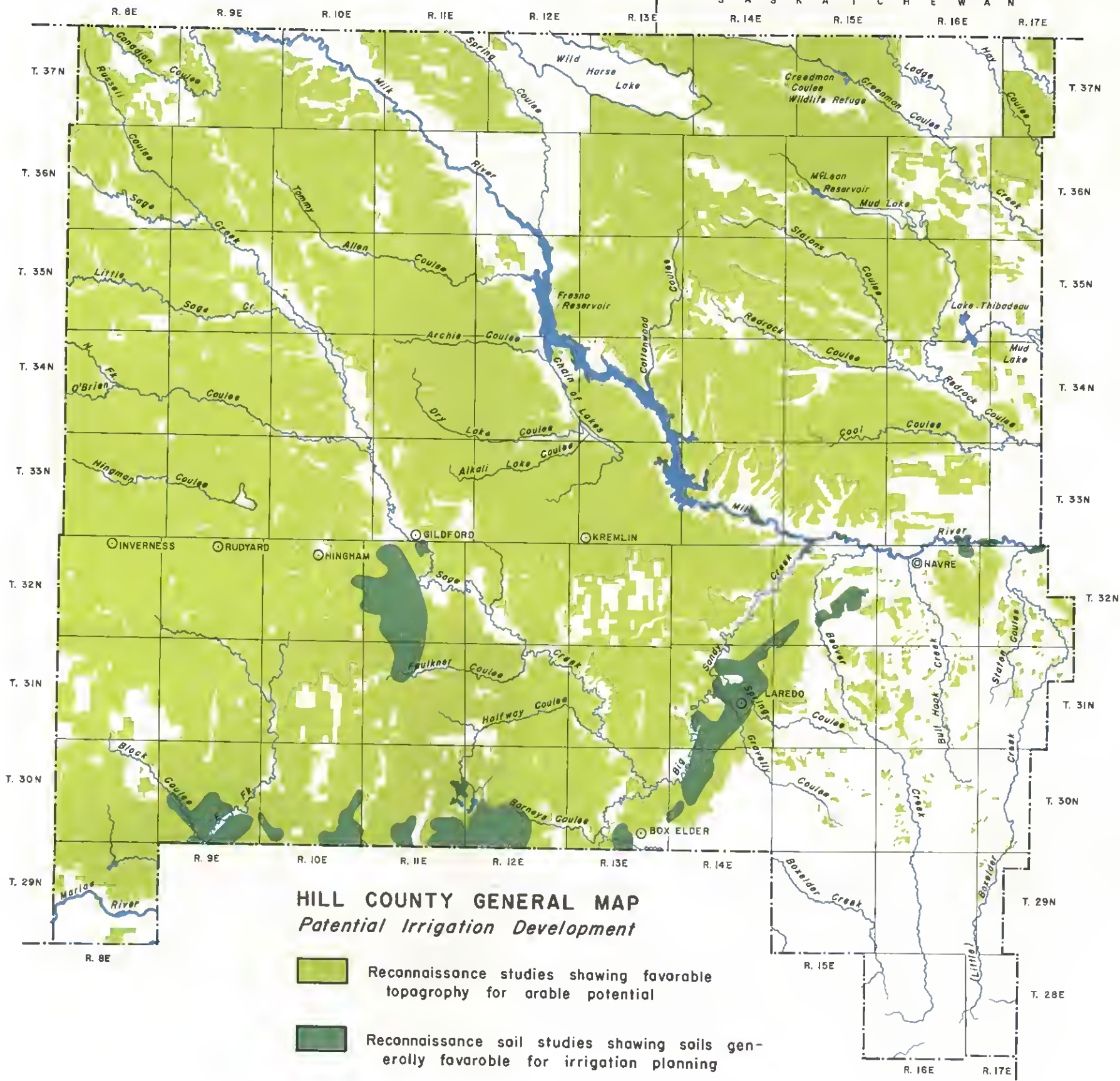
Glacial Soils

The major event in the geologic history which influenced the soils of Hill County was continental glaciation. Glacial soil is the unconsolidated mantle of disintegrated and decomposed rock material transported by a glacier as a mixture of clay, sand, silt, and boulders. The material deposited by moving ice is glacial till. During the retreat of the ice, the running water segregated the material according to particle size. The coarse materials, sand and gravels, usually settled out near the margins of ice, and the fine materials, silt and clay, settled farther from the ice margins. These latter materials often were deposited in bodies of still water such as lakes and ponds. Materials deposited by the melt water are defined as glacial drift.

Glacial material was deposited over most of the area of North Central Montana with the exclusion of the mountainous regions of the Bearpaws, Little Rockies, and Highwoods. Portions of the Bearpaws lie within Hill County. The steep, rugged, and mountainous topography of the western, northern, and southern slopes of the Bearpaws does not have benches or gentle slopes extending over sufficiently large areas to merit irrigation development planning.

The glaciated plains of Hill County comprise one of the better producing areas of dryland wheat and barley crops in the State. The quality of winter wheat is rated among the nation's highest. However, the annual precipitation is not consistent and prolonged periods of drought may curtail crop production for several years at a time. A study of potential benefits which might derive from irrigation development in the western portion of the county indicates that such a program would not only help to stabilize the agricultural economy but would also benefit the communities in the area.

The soils have three primary layers. The top layer may range in depth from 1" to 4" and it is generally dark grayish-brown in color; the upper part is loose and powdery forming a surface mulch. The next layer varies from a silt loam to a clay loam and it is a rich dark brown color; it is firm and somewhat compact with a slightly defined columnar structure. This second layer sometimes reaches a depth ranging from 8" to 15" depending upon the local conditions such as micro-relief which determines the moisture supply during formation of the soil. Below this layer lies a



grayish-brown splotched or speckled carbonate layer which may be high in salt content. Hidden beneath the soil solum is a parent material of glacial till containing a maze of aquifers and barriers within the clay and sand lenses; in general, these are not water bearing sand or gravel. The substratum of any one type of soil does not extend over large areas but occurs largely as lenses or pockets. This substratum may be high in salts but the moisture received under natural precipitation is not great enough to transpire any high amounts of salinity to the plant root zone. Whenever a substratum such as till is near the surface, irrigation may cause a water table to rise and this will convey high amounts of salts to the plant root zone.

Where such conditions prevail the construction of drainage systems is necessary to remove excessive water and to allow leaching of salts out of the root zone. The depth of the soil over the till barrier, and soil permeability are generally the determining factors of the drainage costs. If the till is shallower than the 4 foot root zone, then in all probability the costs of drainage would exceed the anticipated irrigated crop benefits.

Western Hill County has approximately 24,600 acres of land worthy of consideration for irrigation. Soils and drainage surveys show that the depth and permeability of the soil over till are adequate to allow installation of drains at a reasonable cost. Diversified irrigated farming of climatically adapted crops, such as sugar beets, small grains, alfalfa, and corn silage could be grown in this area. New technology in irrigation practices, and the need for greater crop production may warrant future consideration of irrigation planning on larger areas of the glaciated uplands in the western section of the county.

The glaciated plains, situated in the area of Beaver, Big Sandy, and Bullhook Creeks, contain 1,000 acres for potential irrigation planning. Drainage costs, however, would be high due to the shallow soil depth over a compact glacial till. Small acreages of this area presently are being irrigated from a storage reservoir and the main stream of Beaver Creek. The existing water supply is inadequate and the extent of seepage has not been determined at this time.

The soils in the northeastern section of Hill County were developed by glacial movement which deposited the shale-like material from the Bearpaw formation. These soils have a shallow solum with high alkaline salt content, and the desolate appearance of "slick spots," "scab areas," and "blow-outs." The dryland cultivated areas are limited to the better soils, but even these may be marginal. The principal land use in the northeast section of the county is the production of native grasses for livestock grazing.

The northern section of Hill County has numerous small glacial lakes which are supplemented by snowmelt water. The largest of these glacial lakes is Wild Horse Lake which intermittently fills with supplemental water; presently there are small tracts of irrigated land in the northwestern portion of the lake bottom. The lacustrine soil deposits of the lake bottom are slowly permeable clays which are not considered satisfactory for irrigation. The land bordering the lake is rolling and undulating; the soil in the southwestern portion is light to very light textured. There are scattered areas of the light textured soils which may have potential for sprinkler-type irrigation, but a limiting factor would be a presently inadequate water supply. Exploration of underground water sources could determine the location, quantity, and quality of water available for pumping. A complete soil study also would be necessary to locate the lands which may lend themselves to irrigation planning.

Alluvial Soils

The alluvial soils occur largely within the Milk River and Big Sandy Creek valleys; smaller quantities, however, are found in every stream and drainage throughout the county. Characteristics of the soils generally are influenced by the parent material. The material below the surface soil is basically the same as it was at the time of deposition.

When the first continental ice sheets advanced southward, the area west of the Bearpaw Mountains and southwest of the Milk River had considerably greater topographic relief than at present. During the pre-glacial period the Missouri River flowed northeastward along the west base of the Bearpaws. Geologic data indicates the pre-glacial valley of the Missouri River is so completely filled with glacial deposits that there is little surface indication of the valley's presence. The alluvium of Big Sandy Creek and its tributaries has completely covered the glacial deposits except for a few glacial gravel terraces and small glacial lake areas. There are approximately 11,000 arable acres of alluvial deposited soils within the portion of Big Sandy Creek Valley ranging from the small settlement of Box Elder to four miles north of the small settlement of Laredo. The soil textures are loam to clay loam surface with coarser textured materials at lower levels. The alkalinity and salinity measurements are within the tolerance for growth of climatically adapted irrigated crops of sugar beets, small grains, alfalfa, corn and irrigated pasture grasses.

There are also large areas of non-arable land within the bottom lands and on the gentle slopes of the upland portions adjacent to Big Sandy Creek Valley. The small creeks and drainage coulees on the western slopes of the Bearpaw Mountains have deposited alluvial fans which changed the course of the creek to the west side of the valley. The heavy textured alluvial soils in the old channels and those adjacent to the creek are very slowly permeable and high in salinity. There are large areas of Solodized-Solonetz type soils, which are considered "scabland," within the valley and are limited to dryland grazing.

The major stream in Hill County is the Milk River, an international stream flowing from Canada into the northwestern portion of Hill County. The stream meanders through a narrow valley which is bordered by rough escarpments of shale and glacial moraine formations extending to the mouth of Big Sandy Creek. The Milk River follows the ancestral valley of the Missouri River from the mouth of Big Sandy Creek to the Blaine County line.

The narrow valley between the Canadian border and the Fresno Reservoir contains small alluvial terraces and colluvial slopes bordering the Milk River. The terrace and slope soils were formed from heavy textured parent materials high in alkalinity and salinity. Irrigation development for this portion of the river valley seems improbable because of the high saline and alkaline content of the soil which restricts crop growth. The potential of the valley from the Canadian line to the Fresno Reservoir is limited to dryland grazing.

The Milk River Valley from Fresno Dam to the Blaine County line has small tracts of land irrigated by individual pumping directly from the river. The soils are mostly light to heavy textured river alluvium and colluvial-alluvial outwash fans from small coulees that drain into the Milk River. The crop yields of irrigated alfalfa, small grains, corn silage, and potatoes are influenced by the quality of soil; the higher yields are obtained from light to medium textured alluvial soils.

The north side of the Milk River Valley near Havre is bordered by a rough, steeply eroded escarpment that is known as the Havre Badlands. The recent erosion of the Badlands has washed a high alkaline silty soil onto the river-deposited alluvial fans rendering the areas impractical for irrigation or dryland farming. The effects of this erosion are evident from the very poor crop yields on irrigated land in this area.

Only limited future irrigation development of the Milk River Valley from Fresno Dam to the Blaine County line seems to be practicable. There are 1,500 acres of potential arable land located in several small tracts from Fresno Dam to the Blaine County line; the soils are light to medium surface texture with coarser texture subsoils.

There are a number of small creeks which have headwaters in the Bearpaw Mountains. These creeks flow north through the mountainous terrain, and terminate in the Milk River near Havre. The narrow valley of Beaver Creek has small tracts of irrigated land that are producing satisfactory yields of hay and alfalfa. The potential new land for irrigation is limited by the small acreages in the creek valleys and the small supply of available water.

The majority of the glacial plains west of the Milk River are drained by Sage Creek. The narrow valley is undulating and the topography is divided into small tracts by the meandering creek channel and the small intermittent tributaries. The soils are formed from the local parent material which is high in alkalinity. The small acreage and the high alkaline soils do not warrant any extensive irrigation planning.

The northeastern part of Hill County is drained by small creeks which meander through the Bearpaw shale formation. The alluvial soils formed here are high in salinity, alkalinity, and clay content. The non-arable soils, limited water supply, and water quality have restricted the land use of the small creek valleys to dryland grazing.

References

- DeYoung, William, Montana Agriculture Experiment Station and Youngs, F. O., and Glassey, T. W., U.S. Department of Agriculture, 1928, Soil Survey of the Milk River Area, Montana: U.S. Department of Agriculture, Bulletin, Series 1928, Number 22.
- Geiseker, L. F., and Morris, E. R., Montana Agriculture Experiment Station and Strahorn, A. T., and Manifold, C. B., U.S. Department of Agriculture, 1929, Soil Survey (Reconnaissance) of the Northern Plains of Montana: U.S. Department of Agriculture, Bulletin, Series 1929, Number 21.

CROPS AND LIVESTOCK

Hill County, located in north central Montana, is 59 miles wide and about 48 miles long. The county covers an area of 2,944 square miles. Small grains and some livestock are produced in most areas of the county. The Bearpaw Mountains are located in the southeastern portion and are primarily a range livestock area. Covering an area of 1,872,640 acres, the county has around 850 operating farms. The Rocky Boy Indian Reservation is located in the southeastern portion of the county.

According to the 1959 Bureau of Census report, the average farm is approximately 2,117 acres in size with an average value per acre at approximately \$57.68.

A majority of the farms are dryland operations. The county has a total of 6,315 irrigated acres of which 2,200 acres are situated just west of Havre, where the irrigable land lies. The irrigated land receives its water supply from Beaver Creek and from water stored in Fresno Reservoir.

The major crops grown in the county are winter wheat, spring wheat and barley. The largest acreage during the normal years is planted to winter wheat followed by barley and spring wheat; some oats, flax, rye, and mustard are grown but the acreage normally is small.

The majority of the farms throughout the county follow the alternate crop and fallow system to build moisture reserves and carry out a weed control program. A large percentage of the dryland is strip cropped for erosion control and stubble mulching is a universal practice. The entire county is included in a Soil and Water Conservation District with about 400 farmers cooperating under the program.

There is no organized Weed Control District in Hill County. Perennial noxious weeds are not a serious threat to crop production as yet. The county road crew sprays road rights-of-way and barrow pits.

The 1964 statistical report from the Agricultural Marketing Service lists a total of 32,400 cattle and calves raised in the county, 1,100 milk cows, 1,600 hogs and pigs and 3,600 sheep and lambs. The cattle numbers remain quite stable with some increase in farm feedlot feeding. The number being fed fluctuates with the price of feed barley and finished cattle.

The dairy herds in the county have been decreasing with the remaining herds increasing in size; the latter supply milk to two milk plants in Havre.

Hog production in the county is relatively stable with several large swine enterprises and a number of small farm swine herds. Several operators are interested in expanding their operations.

Sheep production has decreased in past years but is now stabilized to several small farm flocks of the wool-type breeds.

Three operators are marketing graded eggs on a commercial basis and have a minimum of 2,000 laying hens. Farm flocks of chickens and other poultry are continually declining in numbers.

The following is a summary of land use in the county: Cultivated land, 1,005,665 acres; Irrigated land, 6,315 acres; Forest, 8,000 acres; Range land, 785,905 acres; Cities, roads, etc, 10,110 acres.

The following table contains data from the USDA Statistical Reporting Service at Helena, Montana, 1964.

CROP PRODUCTION—HARVESTED AREAS

Crops	Irri- gated Acres	Yield /Acre	Acres	Non- Irrigated Yield /Acre	Acres	Bushels	Value
Winter wheat.....	.....	.....	199,100	18.0	199,100	3,583,800	\$6,271,600
Durum.....	.....	.....	4,900	14.0	4,900	68,600	135,800
Spring wheat.....	100	28.0	114,700	14.0	114,800	1,608,600	3,104,600
Oats.....	300	36.0	3,500	23.0	3,800	91,300	46,600
Barley.....	200	38.0	147,900	18.0	148,100	2,669,800	1,842,200
Mustard seed.....	.....	.....	4,800	360 lbs.	4,800	1,728,000 lbs.	112,300
Flax seed.....	.....	.....	200	5.0	200	1,000	2,500
Potatoes.....	8	125.0 cwt.	16	35.0 cwt.	24	1,600 cwt.	3,900
All hay.....	2,800	2.43 T.	25,200	.93 T.	28,000	30,200 T.	596,400
Alfalfa hay.....	2,100	2.80 T.	3,100	1.30 T.	5,200	9,900	.....
Wild hay.....	600	1.10 T.	2,600	.75 T.	3,200	2,700 T.	.....

Total crop receipts in 1961 were \$10,901,100 and livestock receipts totaled \$2,955,900.

STREAM GAGING STATIONS

The U. S. Geological Survey measures the flow of streams, cooperating with funds supplied by several state and federal agencies. The results have been published yearly in book form by drainage basins in Water-Supply Papers through the year 1960. Beginning with 1961, the streamflow records have been published annually by the U. S. Geological Survey for the entire state under the title, "Surface Water Records of Montana." Data for 1961-65 and subsequent five-year periods will be published in Water-Supply Papers. Prior to general issuance, advance copies of station records may be obtained from the U. S. Geological Survey. The agency's records and reports have been used in the preparation of this resume'.

Data given below cover the stream gaging records, which are available for Hill County from the beginning of measurements through the water year 1965. The water year begins October 1 and ends September 30 of the following year.

Following are equivalents useful in converting from one unit of measurement to another:

- (a) In Montana, one cubic foot per second equals 40 miner's inches.
- (b) One acre-foot is the amount of water required to cover an acre one foot deep.
- (c) One cubic foot per second will nearly equal two acre-feet (1.983) in 24 hours.
- (d) A flow of 100 miner's inches will equal five acre-feet in 24 hours.
- (e) One miner's inch flowing continuously for 30 days will cover one acre 1½ feet deep.

For reference purposes, the stream gaging stations are listed in downstream order.

Marias River near Brinkman

The water-stage recorder was 4 miles southwest of Brinkman Post Office, 14 miles downstream from Cottonwood Creek, and 30 miles north of Fort Benton. The drainage area is 6,425 square miles, of which 518 square miles is probably noncontributing. Records are available from October 1921 to September 1956. The maximum discharge during the period of record was 50,700 c.f.s. (June 19, 1948) and the minimum daily, 1 c.f.s. (December 17, 18, 1955). The flood of June 1908 reached a discharge of about 70,000 c.f.s. The average discharge for 34 years (1921-1955) was 952 c.f.s. or 689,200 acre-feet per year. The highest annual runoff was 1,440,000 acre-feet (1927) and the lowest, 79,360 acre-feet (1956, when flow was completely regulated by Tiber Reservoir after October 28, 1955). Prior to October 1955 low flow was regulated by four reservoirs having a combined capacity of 177,870 acre-feet.

Milk River at Eastern Crossing of International Boundary*

The water-stage recorder is 500 feet south of international boundary, 30 miles north of Rudyard, Montana, and 37 miles south of Many Berries, Alberta. The drainage area is 2,588 square miles. Records are available from August 1909 to date (1966)—few winter records. The maximum discharge was 10,700 c.f.s. (April 9, 1965) and the minimum, no flow at times. Since 1917, the flow has been increased during the irrigation season by discharge of St. Mary Canal. There are small diversions for irrigation above the station. This is one of a number of stations which are maintained jointly by the United States and Canada.

Sage Creek at International Boundary*

The water-stage recorder is a quarter of a mile north of international boundary, 1 mile east of Wild Horse Port of Entry, and 5 miles north of Simpson, Montana. The drainage area is 220 square miles. Records are available from March 1946 to date (1966), seasonal records only. The maximum discharge was 52 c.f.s. (September 6, 1951) and the minimum, no flow for most of each year. There are many diversions for irrigation above the station. This is one of a number of stations which are maintained jointly by Canada and the United States.

Milk River above Havre

The water-stage recorder was a quarter of a mile upstream from Big Sandy Creek and 6 miles west of Havre. The drainage area is 3,826 square miles. Records are available from May 1928 to September 1933. The maximum discharge was 2,540 c.f.s. (June 21, 1928) and the minimum observed, 1.8 c.f.s. (January 10, 1933). The average discharge for 5 years was 310 c.f.s. or 224,400 acre-feet per year. The highest annual runoff was 283,000 acre-feet (1929) and the lowest, 164,000 acre-feet (1931). Since 1917, the flow has been increased during the irrigation season by flow of St. Mary Canal. There are small diversions for irrigation above the station.

Sage Creek near Kremlin

The water-stage recorder was 8 miles south of Kremlin and 16 miles upstream from the mouth. The drainage area is 914 square miles. Records are available from October 1945 to September 1951. The maximum discharge was 942 c.f.s. (March 19, 1947) and the minimum, no flow for most of each year.

The flow in April 1952 reached a maximum discharge of 3,520 c.f.s., from slope-area measurement of peak flow. The average discharge for six years was 1.88 c.f.s. or 1,360 acre-feet per year. The highest annual runoff was 5,860 acre-feet (1947) and the lowest, no flow (1949). Natural flow is affected by small storage reservoirs above the gage.

Big Sandy Creek near Box Elder

The staff gage was located just below the mouth of Sage Creek at Cowan ranch and 3 miles north of Box Elder. The drainage area is 1,629 square miles. Records are available from March 1927 to December 1938. The maximum discharge observed was 2,000 c.f.s. (May 24, 1927) and the minimum, no flow at times. The average discharge for 11 years was 6.59 c.f.s. or 4,770 acre-feet per year. The highest annual runoff was 15,400 acre feet (1928) and the lowest, 198 acre-feet (1935). The flow is regulated by a small storage dam and some diversions for irrigation above the station.

Big Sandy Creek near Laredo

The wire-weight gage was $4\frac{1}{2}$ miles northwest of Laredo. The drainage area is 1,752 square miles. Records are available from March 1918 to September 1920. The maximum discharge observed was 4,550 c.f.s. (March 20, 1918) and the minimum, no flow at times. There are some diversions for irrigation above the station.

Big Sandy Creek near Assiniboine

The water-stage recorder is 2 miles northwest of Assiniboine, 6 miles upstream from mouth, and 22 miles downstream from Sage Creek. The drainage area is 1,805 square miles. Records are available from February 1946 to November 1953 (continuous), water years 1955-65 (annual maximum). The maximum discharge for 7 years (1946-53) was 25.2 c.f.s. or 18,240 acre-feet per year. The highest annual runoff was 80,020 (1952) and the lowest, 68 acre-feet (1949). There are diversions for irrigation of about 1,000 acres above the station.

Beaver Creek near Havre

The staff gage was located 2 miles south of old buildings at Fort Assiniboine, 6 miles southwest of Havre, and 10 miles upstream from mouth. The drainage area is 87.4 square miles. Records are available from May 1918 to September 1921 (no winter records except 1919). The maximum discharge observed was 1,500 c.f.s. (July 13, 1920) and the minimum, no flow at times. There are several small diversions for irrigation above the station.

Milk River near Havre*

The wire-weight gage is on the upstream side of highway bridge on 7th Avenue East in Havre, 30 feet downstream from Bullhook Creek, 9 miles downstream from Big Sandy Creek, and 17 miles downstream from Fresno Dam. The drainage area is 5,844 square miles, of which 670 square miles are probably noncontributing. Records are available from May to November 1898, April 1899 to November 1922, March, April 1923, March, April 1952 (gage heights only), June 1953, August 1954 to date (1966). The maximum discharge was about 20,000 c.f.s. (April 12, 1899) and the minimum, no

flow at times in several years. The average discharge for 17 years (1899-1916), prior to operation of St. Mary Canal, was 273 c.f.s. or 197,600 acre feet per year; 17 years (1916-22, 1954-65, 727 c.f.s. or 291,800 acre-feet per year). The highest annual runoff was 527,000 acre-feet (1965) and the lowest, 28,300 acre-feet (1905). There are diversions for irrigation of about 6,000 acres above station. Since 1917, flow is increased during the irrigation season by discharge of St. Mary Canal.

Box Elder Creek near Havre

The staff gage was 17 miles southeast of Havre. The drainage area is 23.7 square miles. Records are available from June 1919 to December 1921. The maximum discharge was not determined (July 13, 1920) and the minimum observed, 0.1 c.f.s. (August 27 to September 3, 1919). Runoff was 4,550-acre-feet (1920) and 3,910 acre-feet (1921). There are several small diversions for irrigation above the station.

Box Elder Creek at P.X. Ranch, near Havre

The staff gage was on the P.X. Ranch, 15 miles southeast of Havre. The drainage area is 33.3 square miles. Records are available from May to November 1918. The maximum discharge observed was 7.5 c.f.s. (May 9) and the minimum observed, 0.1 c.f.s. (September 19-30). There are some diversions for irrigation of hay meadows above the station.

Lodge Creek at International Boundary

The water-stage recorder was 1 mile north of international boundary, 1½ miles upstream from McRae Coulee, and 31 miles north of Havre. The drainage area is 753 square miles. Records are available from April 1910 to October 1951 (few winter records). The maximum discharge was 5,110 c.f.s. (March 30, 1943) and the minimum, no flow at times in each year. The flood of April 13, 1952 reached a discharge of 4,990 c.f.s. The average discharge for 8 years (1917-18, 1919-20, 1921-22, 1929-31, 1933-34, 1935-37) was 32.9 c.f.s. or 28,820 acre-feet per year. The highest annual runoff recorded was 57,100 acre-feet (1918) and the lowest, 490 acre-feet (1931). Different segments of the natural streamflow are affected by storage reservoirs, diversions for irrigation, and return flow from irrigated areas. This is one of a number of stations which are maintained jointly by Canada and the United States.

McRae Creek at International Boundary

The water-stage recorder was three-quarters of a mile upstream from mouth, 1¼ miles north of international boundary, and 31 miles north of Havre. The drainage area is 59.0 square miles. Records are available from March 1927 to October 1951 (few winter records). The maximum discharge was 976 c.f.s. (about March 29, 1943) and the minimum, no flow for most of each year. Flood of April 7, 1952 reached a discharge of 1,160 c.f.s. There is no diversion above the station. This is one of a number of stations which are maintained jointly by Canada and the United States.

Lodge Creek below McCrae Creek, at International Boundary*

The water-stage recorder is a quarter of a mile downstream from McRae Creek, 0.4 mile north of international boundary, three-quarters of a mile northeast of Willow Creek Port of Entry, and

31 miles north of Havre. The drainage area is 818 square miles. Seasonal records are available from October 1951 to date (1966). Prior to October 1951, records were collected on both McRae Creek and Lodge Creek above McRae Creek. Summations are equivalent to records at this site. The maximum discharge was 7,760 c.f.s. (June 14, 1962) and the minimum, no flow at times in each year. Storage reservoirs, diversions for irrigation, and return flow from irrigated areas affect different segments of the natural stream flow. This is one of a number of stations which are maintained jointly by Canada and the United States.

Woodpile Coulee near International Boundary*

The water-stage recorder is 600 feet downstream from Antelope Coulee, 1¼ miles south of international boundary, 7 miles upstream from mouth, and 30 miles north of Havre. The drainage area is 60.2 square miles. Records are available from March 1927 to date (1966), seasonal records only in most years. The maximum discharge was 3,090 c.f.s. (March 30, 1943) and the minimum, no flow for most of each year. Stock-water reservoir constructed in summer of 1947 a quarter of a mile upstream; capacity not more than 30 acre-feet. Seepage from reservoir sometimes produces long periods of flow below 0.05 c.f.s. This is one of a number of stations which are maintained jointly by the United States and Canada.

Partial Record Stations and Miscellaneous Discharge Measurements

In order to provide information on more streams than are covered by stream gaging stations, the U. S. Geological Survey has for several years been collecting some partial records. These are in addition to the miscellaneous discharge measurements which have always been reported. These partial records, when correlated with simultaneous discharges of nearby continuous-record stations, give fair indications of available flow.

There are five crest-stage partial-record stations in the Milk River Basin in Hill County. Stations are now (1966) being operated on Sage Creek tributary at Hingham, South Fork Spring Coulee near Havre, Spring Coulee near Havre, Big Sandy Creek near Assiniboine (former continuous record site), and Bullhook Creek near Havre.

Reservoirs

Details of operation of the following reservoir are available in U. S. Geological Survey Publications.

Fresno Reservoir near Havre

The mercury gage is on the dam on Milk River, 13 miles west of Havre. The drainage area is 3,766 square miles, of which 671 square miles are considered noncontributing. Records are available from January 1940 to date (1966). The maximum contents observed was 154,000 acre-feet (April 3, 1952) and the minimum, no storage (February 18 to March 6, 1950). The usable capacity is 127,200 acre-feet between elevations 2,530 feet (crest of tunnel inlet) and 2,575 feet (crest of permanent spillway). Water is used for irrigation.

* This gaging station is now in operation (1966).

DAMS AND RESERVOIRS

The State of Montana has no statutes governing the design or construction of dams and, except for projects which the State Water Conservation Board has constructed, the Board has no means of automatically obtaining information concerning design specifications, storage capacities, locations, or ownerships of dams and reservoirs built throughout the State. Consequently, steps have been taken to make this information available for use by the State, the Federal Government, and private citizens.

By means of a questionnaire, the State Water Conservation Board recently obtained from the various federal agencies who design structures, the basic engineering data, locations, and ownerships of dams and reservoirs for which they either have, or had, responsibility and which have storage capacities of 50 acre-feet or more. The contributing federal agencies were the Soil Conservation Service, the Forest Service, the Bureau of Reclamation, and the Bureau of Land Management. The Montana Power Company also participated in the study.

Information on numerous dams and reservoirs constructed by private individuals in Montana is not available and is, therefore, omitted. However, the Board's Water Resources Survey crew, while working in Hill County, obtained information on private dams and reservoirs within this county.

The available information obtained from all sources was compiled by the Board for each county in the State and a list of dams and reservoirs which store 50 acre-feet or more of water was published.

In Hill County there are sixty-two reservoirs having capacities of 50 acre-feet or more; two of these reservoirs store between 500 and 1,000 acre-feet of water, and two others store 1,200 and 129,000 acre-feet, respectively.

The main International Streams which rise in Canada and flow into Hill County are Lodge Creek and Battle Creek. On Lodge Creek in Hill County there are no reservoirs having a capacity of 50 acre-feet or more. On minor International streams and coulees in Hill County there are four reservoirs having a capacity of 50 acre-feet or more, and there are sixteen others having capacities of less than 50 acre-feet.

GROUND WATER

Summary

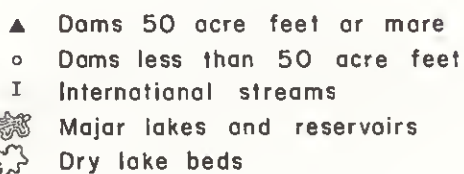
Ground water studies have not been made in Hill County, except a reconnaissance in the southern part.

The general cover of glacial drift is a poor aquifer (water-yielding material), except where glacial outwash gravel and sand are encountered. Most of the water is of poor quality, being mineralized with sodium sulfate.

Water of fair quality is generally available from the Judith River Formation in quantities sufficient for domestic and stock use.

Alluvial fans formed by streams leaving the Bearpaws are potential sources of ground water of good quality. Buried stream channels in the valley of Big Sandy Creek may yield water.

R. 8E	R. 9E	R. 10E	R. 11E	R. 12E	R. 13E	R. 14E	R. 15E	R. 16E	R. 17E
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Deeper drilling to the Eagle Sandstone is possible, but the water quality ranges from fair to poor, and it is also possible to encounter natural gas in such water wells.

The files of the Montana Bureau of Mines and Geology contain 750 water well filings from Hill County. These wells are classified by the Bureau's Ground Water Division: 273 domestic, 213 stock and domestic, 197 stock, 16 irrigation, 16 unknown use, 10 unused, 10 public, 6 commercial, 5 institutional, and 4 industrial wells.

Geology

The distribution of groundwater in Hill County is directly related to a glacio-fluvial environment dating back approximately 1,000,000 years, to the beginning of the Pleistocene era. Prior to this the most significant geologic event affecting the groundwater potential was the period of tectonism which spawned the Bearpaw uplift. Associated with this tectonism was the development of shallow faults in and near the Bearpaw Mountains and the capping of the structural uplift with volcanic lavas.

Glaciers invaded Hill County from the north, in sheets of ice which rode over plains, hills, and valleys to the flanks of the Bearpaw Mountains. The glacial epoch was marked by the advance and retreat of segments of multiple continental ice sheets and persisted until about 50,000 years ago. The physical evidence remaining from this epoch is a mantle of till over all of Hill County, except for the higher elevations of the Bearpaw Mountains. A significant consequence of glaciation was the disruption of the drainage pattern of major streams and their tributaries. Ice advancing toward the south and southeast covered all stream beds in its path, eventually diverting the Missouri River from its channel skirting the western and northern edges of the Bearpaw Mountains into its present course south of the mountains. Big Sandy Creek and a portion of the Milk River occupy the preglacial Missouri River valley. The preglacial Marias River was a major west-to-east flowing stream that occupied a broad valley north of its present course. Sage Creek presently follows a course that appears to have been that of a southeast-flowing major stream prior to the glacier advance. Dry lake beds of large areal extent in northeastern Hill County contain thick sequences of sediment similar to deposits of glacial lakes elsewhere that provide important storage of potable water.

The outcrop pattern of bedrock formations reflects the influence of structural uplift of the Bearpaw Mountains, the Highwood Mountains south of Hill County, and the Sweetgrass Arch to the west. Structural dip in the county is to the north and east, with a maximum relief of approximately 4,250 feet on the deeper formations. The outcrop pattern in the plains area is slightly modified by shallow faulting. In some instances this has brought bedrock aquifers closer to the surface. Faulting apparently has influenced the development of a local drainage pattern in the vicinity of dry lake beds in northeastern Hill County.

Aquifers

There is reasonable assurance of obtaining some groundwater almost everywhere in the county. The more accessible aquifers are lenticular, of limited lateral extent and variable reservoir character. However, there is no certainty of finding a particular aquifer at a specific site and a specific depth. Groundwater is abundant for domestic and stock needs, municipal supplies, and limited irrigation. An aquifer capable of providing a sustained yield suitable for large scale irrigation has not yet been

developed. The aquifers are described individually in sequence of geologic age, the youngest or most shallow first and the oldest or deepest last. Water well data have been taken from well appropriation forms filed with the Groundwater Code Administrator.

Alluvium (Quaternary)— is stream, river, and lake deposits composed of silt, sand, gravel, and clay, mixed and interbedded, of recent geologic age and normally unconsolidated or only weakly cemented. In Hill County these are alluvial fans of tributaries which head in the mountains and flood plain deposits of Big Sandy Creek and the Milk River.

Gravels of the low alluvial fans are good aquifers but have limited water supplies. Shallow fans, about 20 feet deep, have a tendency to dry up in late summer when their water supply drains into the depleted Big Sandy Creek. Adequate supplies for domestic use are obtained from fan gravels at depths of about 35-60 feet. Water in the fans generally has less than 1,000 ppm (parts per million) total solids.

Flood plain deposits of the Big Sandy Creek and the Milk River are from 25 to 75 feet thick and are poor aquifers. These deposits contain much clay derived from glacial and paludal material through which the streams and their tributaries flow. Potable water is obtained from sediments underlying the flood plains in the valley of the preglacial Missouri River.

Glacial Deposits (Quaternary)— include both aquifers and aquicludes. The glacial till that mantles much of the county seldom is an extensive aquifer due to the high percentage of impervious material present. The glaciofluvial deposits that have filled the preglacial valleys contain beds of very permeable sands and gravels. The sands and gravels constitute a small proportion of the total valley fill but are important aquifers. In areas where till predominates, the thickness of the till from the surface to the base of the deepest boulder interval varies from 10 feet to 100 feet in drilled wells. A depth of 189 feet has been recorded to the base of the boulders at the western edge of the Big Sandy flood plain near the town of Box Elder. The thickness of the boulder interval varies from 6 feet to 40 feet. Two separate intervals of boulders have been observed in some wells. The coarser and more permeable material associated with till, such as outwash and ice-margin deposits, can become fair aquifers if dependable sources of recharge exist. Permeable glacial deposits include the disconnected low sand and gravel benches along the western edge of the Big Sandy valley in Townships 30 and 31 North, and on the eastern edge of the valley near the town of Box Elder. These benches have been attributed to glaciofluvial deposition during one of the late periods of thawing.

Valley fill is a heterogeneous accumulation of glaciofluvial clastic material which collected in valleys and depressions during the glacial epoch. The valley fill in the preglacial Missouri channel extends to a common slope depth of about 165 feet and locally to a depth in excess of 200 feet. The fill includes gravel and coarse-sand aquifers of limited extent. These aquifers provide adequate water supplies for domestic and stock needs and most likely would provide moderate yields, perhaps 300+ gpm (gallons per minute) locally from large-diameter wells. The preglacial Marias valley fill in Hill County has a slope depth of 200 feet and a maximum of nearly 300 feet locally. Discontinuous lenses of gravel and sand in the valley fill generally are moderately productive, but these are not extensive aquifers and therefore are considered incapable of large sustained yields. The Marias valley fill would be expected to have yields in the same range as the Missouri valley fill. Valley-fill water-quality generally is not as good as that of alluvial-fan water, but the water is suitable for livestock and can be tolerated by humans.

R. 8E	R. 9E	R. 10E	R. 11E	R. 12E	R. 13E	R. 14E	R. 15E	R. 16E	R. 17E
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The elongate Chain of Lakes depression in T. 33N and 34N—R. 12E and 13E is reported as being the surface expression of a preglacial Milk River trench which is transverse to the present course of the Milk River above its confluence with Big Sandy Creek. One well in the trench reportedly pumps 15 gpm from gravel 90 feet to 125 feet below ground level.

Sage Creek appears to be an under-fit stream in the abandoned valley of a preglacial major stream. Some water-bearing gravels in the Sage Creek valley are more than 100 feet below land surface, and almost 200 feet below the surface at the junction of Halfway Coulee in T. 31N—R. 13E. Small yields have been reported from these gravels.

Wells completed in alluvial and fill material are not always produced at maximum potential due to sand and silt problems. The thin erratic distribution of water-bearing sands and gravels prohibits the development of large capacity wells. The deep fill has been capable of supplying larger yields than the shallow alluvium. Neither the fill nor the alluvium has been extensive enough to provide dependable large sustained yields at a specific site.

Lake-bed deposits are similar to alluvium and valley fill. Along the International Boundary in R. 12E and 13E is a large depression named Wild Horse Lake. This is a dry lake bed in the glaciated plain, floored with unconsolidated sediment to a depth of 300 feet locally in T. 12E. Where it has been drilled the vertical section has an abundance of silt and clay, and a few thin intervals of gravel. A pumping yield of 50 gpm is reported from the gravels. The full potential of these lake-beds is not yet known.

Terrace Gravels (Tertiary) — are water-bearing in the unglaciated portion of the Bearpaw Mountains. These gravels overlie broken volcanic rock and may be equivalent to the Flaxville gravels of Blaine County which predate the glacial advance. A few wells tap water from these gravels at depths of 35-45 feet and pump about 10 gpm per well.

Volcanic Rocks and Igneous Intrusives (Tertiary) — are present in the mountains and are not normally aquifers. A cluster of wells 35 to 100 feet deep in T. 28N—R. 17E and a well in T. 30N—R. 15E reportedly pump from 4 to 40 gpm from fractured and broken volcanic rock.

Wasatch-Fort Union (Tertiary) — sediments are reported to be present in the mountains as very small scattered remnants. It is doubtful that these could become developed aquifers.

Bearpaw Shale (Cretaceous) — is an eroded interval of blue-black shale several hundred feet thick and not normally an aquifer.

Judith River Formation (Cretaceous) — consists of interbedded sandstones, clays and shales, and coal seams, 400 feet or more in total thickness. The Bearpaw and upper Judith River formations are absent from much of the county area, resulting in the better Judith River sandstone aquifers being nearer the surface. The sandstones are gray and tan, fine-grained, lenticular and discontinuous. The more massive sandstone members are 40-50 feet thick and are found in the basal part of the formation. Water from the Judith River is reported of good quality, suitable for livestock and humans at some well sites but only tolerable by humans at others. Judith River aquifers are found at depths of

75-600 feet, but more commonly at depths of 100-300 feet. Traces of natural gas are sometimes found in the formation.

Claggett Shale (Cretaceous) — is an interval approximately 500 feet thick, similar to the Bearpaw shale and not normally an aquifer.

Eagle Formation (Cretaceous) — underlies the Claggett shale and is 200+ feet of buff-colored silty sandstones and shales in the upper part and a massive sandstone 35 feet to 100 feet thick at the base. The basal sandstone is distinctive enough to be named the Virgelle member, and it is a fair aquifer even though the water is highly mineralized. Total dissolved solids are in the range 1,000-2,500 ppm, and as high as 5,000 ppm locally. Artesian aquifers in the Eagle are found at depths of 250 feet to 1,500 feet. Commercial amounts of natural gas are found locally in this formation in Hill County.

Colorado Shale (Cretaceous) — is 1,800+ feet of bluish-gray shale with thin sandstone lenses and stringers, none of which is considered an aquifer.

Kootenai Formation (Cretaceous) — is part of the Dakota-Lakota sequence which is 200-400 feet of sandstones and shales containing some of the best artesian aquifers in Central Montana. The Kootenai has not been utilized in Hill County.

Ellis Interval (Jurassic) — is a group of limestones, sandstones, and shales which attain a collective thickness of over 400 feet; local potential aquifers may be present. The basal unit in this sequence is capable of producing commercial amounts of natural gas in Hill County.

Madison Limestone (Mississippian) — is a thousand feet of light-colored limestones sometimes having cavernous porosity in an upper massive unit. Large flows of almost unlimited quantities of water are reported in Central Montana. The Madison limestone has not been explored for water in Hill County, but it can be assumed that there are sites within the county where the capability for large sustained yields does exist. Present circumstances do not warrant tapping a reservoir at the Madison subsurface depth which is approximately 3,000 feet.

Pre-Mississippian Aquifers — are present below the Madison in the 2,000+ feet of Devonian-Cambrian sediments. These rocks have not been explored as sources of water due to availability of potable water in shallow aquifers.

Pre-Cambrian — igneous and metamorphic rocks underlie the sedimentary section and can provide water from fractures but normally are not considered aquifers.

Groundwater Areas

Hill County can be apportioned into four geographic groundwater areas: (1) the Milk River and Big Sandy Creek floor plain, (2) the glaciated plain, (3) the glaciated upland, and (4) the unglaciated area.

The Milk River and Big Sandy Creek Flood Plain. Shallow gravels along Box Elder Creek, Spring Coulee, Beaver Creek, and Bull Hook Creek produce good water where these tributaries

meet the flood plain. Aquifer depths are 25 feet to 70 feet below the surface, and reported rates of withdrawal are 4 to 20 gpm pumping. Benches of ice-contact terraces rising slightly above the flood plain are reported near the town of Box Elder and water at a depth of 11 feet, in T. 30N—R. 13E, where Barney's Coulee intersects the flood plain may be in one of these benches. The aquifer is reported as "coarse gravel entire depth," with a "supply of water unlimited." An estimate of withdrawals from one well is given as 360,000,000 gallons per year, which is equivalent to an average of almost 1,000,000 gallons daily or approximately 700 gpm. Under the flood plain are valley fill sands and gravels in the preglacial Missouri valley from depths of about 50 feet to 200+ feet, which are fair aquifers. West of the town of Havre are several wells, 76 to 131 feet deep in sand and gravel; these are reportedly capable of small flow-yields and individually pump 125 to 300 gpm. Near the town of Box Elder valley-fill gravel from a depth of 172-198 feet is pumped for 7 gpm, but probably has a greater potential. A few wells are drilled through the flood plain and edge of the buried valley and into the underlying Judith River bedrock. Judith River aquifers are tapped at depths of 90 to 250+ feet below ground level and produce 3 to 20 gpm.

The Glaciated Plain. The buried Marias valley fill includes gravel and sand aquifers very similar to those in the buried Missouri valley. Marias fill is almost 300 feet thick. The buried valley of Sage Creek contains aquifers along the entire length of Sage Creek. These sands and gravels are from 30 feet to 200 feet below ground level. Yields of 5 to 40 gpm are reported. One well in Section 32, T. 32N—R. 12E was reported flowing 100 gpm from gravel at 169-175 feet. Glacial till mantles all of the plains area. North-south trending "threads" of unconsolidated silt, sand and gravel have accumulated in narrow elongate valleys cut into the till, some more than ten miles long. These thread-like deposits are very thin and not known to be aquifers. Some springs of small yields are reported, and several wells produce from buried lake beds near the International Boundary.

Aquifers in the Judith River and Eagle formations are utilized more than any other in much of the area of the glaciated plain. Judith River water is found at depths of 200 feet to 400 feet below the surface over much of the area and at depths of about 600 feet where the Bearpaw shale overlies the Judith River formation. Towns that depend on bedrock aquifers for municipal supplies tap sandstones in the Judith River formation. Sandstones of the Eagle formation are also utilized by ranchers. Water from the Eagle is highly mineralized and sometimes is not suitable for human consumption. Wherever the Eagle is the only source of shallow water, domestic water generally is transported into the area and water from the Eagle is used for livestock. The normal depth to Eagle aquifers is about 1,000 feet below the surface, ranging from less than 300 feet near the Marias River to 1,500+ feet in the northeastern part of the County.

The Glaciated Upland. The area between the floodplain and the mountains has only 30-50 feet of glacial till covering the Judith River bedrock and Tertiary volcanics. Much of the groundwater is obtained from Judith River sandstones ranging from 70 feet to 500 feet deep with yields up to 15 gpm. Numerous springs are utilized for stock water. Broken volcanic rocks provide small yields locally. Several wells in T. 30N and 31N—R. 16E and 17E reportedly yield from 15 to 100 gpm from gravels at depths of 50 feet to 120 feet. The relationship of these gravels to the volcanic rock at the surface is not apparent from well records. The groundwater potential of this area is somewhat obscured by numerous shallow faults.

Unglaciated Area. Groundwater is available from springs, gravels, bedrock and Tertiary volcanics, but yields are small. Springs are common, although not as numerous as at lower elevations

on the glaciated mountain flanks. Broken volcanic rocks at depths of 35 feet to 100+ feet are tapped for pumping rates of 4 to 40 gpm. Thick beds of gravel up to 35 feet resting on broken volcanic rock are local aquifers and provide about 10 gpm per well pumping.

The higher mountainous area collects precipitation and conducts water into underground bed-rock formations which act as reservoirs. These reservoirs are tilted, causing groundwater movement under artesian conditions from the Bearpaw Arch towards the International Boundary. There is a similar movement from the Arch southward.

References

- Alden, W. C., 1932, Physiography and glacial geology of eastern Montana and adjacent areas: U.S. Geological Survey Professional Paper 174.
- Pierce, W. G., and Hunt, C. B., 1937, Geology and mineral resources of north-central Chouteau, western Hill, and eastern Liberty Counties, Montana: U.S. Geological Survey Bulletin 847-F.
- Ross, C. P., Andrews, D. A., and Witkind, I. J., 1955, Geologic map of Montana: U.S. Geological Survey in cooperation with the Montana Bureau of Mines and Geology.
- Smith, J. F., Jr., Witkind, I. J., and Trimble, D. E., 1959, Geology of the lower Marias River area, Chouteau, Hill, and Liberty Counties, Montana: U.S. Geological Survey Bulletin 1071-E.
- Swenson, F. A., 1957, Geology and groundwater resources of the lower Marias irrigation project, Montana, with a section on Chemical quality of the groundwater by H. A. Swenson: U.S. Geological Survey Water-Supply Paper 1460-B.

ECONOMIC MINERAL DEPOSITS

Geologic Situation

Hill County is in the northern Great Plains physiographic province (generally described as the high plains of the Northwest). The only true highlands in the county are in the southeast corner where about one-quarter of the Bearpaw Mountain uplift is included within the county lines.

Glacial debris of Pleistocene age covers most of the county. Most of the bedrock below the glacial material consists of the sandstone, siltstone, and shale of the Judith River Formation. The Bearpaw Shale overlies the Judith River Formation in the northeast whereas the underlying Claggett Shale and Eagle Sandstone crop out to the southwest. Volcanic and intrusive igneous rocks and older sedimentary strata are exposed in the Bearpaw uplift.

Metallic Minerals

Niobium. — Niobium (columbium) is a steel-gray, lustrous metallic element used principally as an alloying agent in metals for jet aircraft engines. Niobium alloys are stable and retain their strength at temperatures to 1,550° F.

The ore of niobium is columbite, and minor amounts reportedly occur in carbonate rocks associated with the Rocky Boy stock in the Bearpaws. No production has been reported.

A search of the literature shows no recorded production of any metallic mineral from Hill County.

Nonmetallic Minerals

Vermiculite. — Vermiculite deposits near Box Elder on the Rocky Boy Indian Reservation are associated with syenite and pegmatite unusually rich in potash. They are small, but are believed to contain material of quality.

Bentonite.—Bentonite is the commercial name for a type of rock that swells when wet and forms a gel when mixed with water and allowed to stand. Recent technological developments have shown that bentonite can be used as a bonding agent in the pelletizing of taconite (iron) ore.

Bentonite beds in the Bearpaw Shale of northeastern Hill County have not been developed, and the location is somewhat unfavorable because of distance from the railroad.

Clay.—A brick plant and clay pit was, at one time, active in the Havre area. The plant and pit are now inoperative.

Mineral Fuels

Oil and Gas.—Hill County lies east of the extensive oil and gas producing area along the axis of the Sweetgrass arch, and has not been as thoroughly explored, but it includes the Box Elder, Havre, and Kremlin gas fields. Gas was also discovered to the northwest near the Liberty County border in 1966.

The Box Elder gas field, 6 miles southeast of Havre, was discovered in 1931 when a well (Sec. 14, T. 32N—R. 17E) drilled into the Eagle Sandstone at a depth of 1,272 feet flowed 7½ million cubic feet of gas per day. In 1935 another well was drilled. These wells were connected to the Bowes-Havre pipeline. Peak production was about 170 million cubic feet in 1954, but by 1958 production had decreased to about 19 million cubic feet, and no production is listed in the 1965 Annual Review of the Montana Oil and Gas Commission.

The Havre gas field was discovered in 1914, and eventually 26 wells were drilled. Gas came from the Eagle Sandstone at a depth of about 1,000 feet. This gas was marketed in Havre for about ten years. The field is now abandoned.

The Kremlin gas field was named on the basis of a 1957 well (Empire Petroleum Company) drilled in T. 33N—R. 11E, (west of Havre). This well encountered gas in the Sawtooth Formation (Jurassic) at a depth of 3,687 feet. The reported yield was 1.2 million cubic feet per day. The field was shut in without production.

Coal

The Milk River subbituminous coal field extends under virtually all of Hill County except the southwestern part. Mining has been carried on near Havre, where the coal occurs in the upper part of the Judith River Formation as 2.5 to 6.7 foot seams of impure coal with partings of bone and shale. In western Hill County the Judith River contains thin lenticular seams of coal about 200 feet above its base.

The future for coal mining seems less favorable in the Milk River field than in some other fields in the state.

SOIL AND WATER CONSERVATION DISTRICTS

Hill County is served by the Hill County Soil and Water Conservation District which was organized February 28, 1946. The area of the Hill County District is 1,872,640 acres.

The District is governed by a board of five supervisors who are elected by the land occupiers of the district. They carry out a program of complete resource conservation including erosion control, water conservation, soil management, land improvement, wildlife management, recreation and land use adjustment. This program is accomplished by providing assistance to farmers and ranchers, on a voluntary basis, the analyzing of all resources, and the planning and applying of economically sound conservation treatment.

Under state law, the supervisors have the power to call upon local, state and federal agencies to assist in carrying out a soil and water conservation program. The Hill County Soil Conservation District has memoranda of understanding with the Soil Conservation Service, State Forestry Department and Extension Service and Department of Interior to provide technical assistance to district cooperators in carrying out a sound soil and water conservation program. Close working relations are maintained with the Extension Service, the Bureau of Indian Affairs, the Farmers Home Administration, the Agricultural Stabilization and Conservation Committee and the Board of County Commissioners.

The Soil Conservation Service assists the district by furnishing and interpreting basic data on soils and plant cover and other features of the land. Technical data are interpreted in terms of acceptable alternative uses and treatments to help guide the farm and ranch operator in developing sound conservation plans. It also aids district cooperators in performing operations requiring technical skills beyond the experience of the individuals involved.

The office of the State Forester cooperates with the district by coordinating the programs in tree planting.

The Extension Service assists the district with its education and information program. An important function of each district is to inform land owners and occupiers of the benefits derived from wise use of the communities' soil and water resources.

One of the major problems of these districts is to acquaint the urban people, who comprise a large percentage of the total population of the districts, with the need for conservation.

Technical phases of the district's program include detailed soil surveys, range site and condition surveys, ground water investigations, topographic and other engineering surveys. By a careful analysis of this basic resource information, proper land use and needed conservation treatment of each field can be determined. The technician interprets the surveys and provides the district cooperator with alternatives in land use and treatment that will enable him to treat the hazards and limitations that occur on each tract of land. With this information and by counseling with the technician, the farmer or rancher makes the final decisions. These decisions are recorded in the Conservation Plan.

When the plan is completed the cooperator is given further technical assistance on lay-out work essential in establishing conservation practices on the land as called for in the conservation plan. This technical assistance is provided without cost to the cooperating farmer or rancher.

In 1959 there were in private ownership 1,005,665 acres of cropland, 758,905 acres rangeland and tame pasture, 8,000 acres woodland and 10,110 acres of land considered other land. In addition there were 58,559 acres of federal land, 28,721 acres of urban and built-up land and 2,680 acres of water surface.

It is estimated that about 13,000 acres can be irrigated. Most of the irrigation water is obtained by pumping from the Milk River or from private irrigation reservoirs. There is also some diversion from the larger perennial and intermittent streams. One company, the Havre Irrigation Company, diverts water from Beaver Creek to its members through a canal and storage system southwest of Havre.

The major enterprises on agricultural lands are grain and livestock production. Beef cattle, sheep, swine, dairying and poultry enterprises are found in the district. Cash crops produced are small grains and hay.

Work done since the organization of the district on irrigated lands consists largely of improvement of irrigation systems within the farm boundaries, land leveling, construction of permanent ditches, installation of water control structures, farm drainage systems, improved cropping and pasture management systems, soil management and improvement of wildlife habitat. On dryland pasture and range, the work done has been improvement of vegetative cover through seeding, deferred-rotation grazing, fencing, livestock water development and improvement of wildlife habitat.

On non-irrigated cropland the conservation effort has been mainly the establishment of conservation cropping systems that would effectively control erosion. This has involved the use, singly or in combination, of such practices as wind stripcropping, stubble mulch tillage, field windbreaks, grassed waterways and sediment detention dams.

A considerable amount of conservation work has been accomplished through efforts of organized groups and this is encouraged wherever possible.

The Hill County Soil and Water Conservation District owns equipment consisting of a grass drill and a fertilizer and chemical spreader for weed control in tree rows. These are available to district cooperators on a rental basis to carry out needed conservation measures.

Cooperative efforts of land owners and operators, other groups and agencies have contributed to the overall success of the district.

Water resources available in the district include sources originating in Hill County as well as sources coming into the county from other areas. The Milk River, Marias River, Lodge Creek and Big Sandy Creek are the main sources of "foreign" water. In addition there are several smaller intermittent streams mainly on the north and west borders of the district that bring in water from adjacent areas. The streams coming in from the north bring water from Canada.

There are many tributaries to the main streams listed above which originate within the district. Of these the most perennial in nature are those originating in the Bearpaw Mountains in the southeast part of the district. The most productive of these from an irrigation water standpoint are Box Elder Creek (flowing west to Box Elder), Beaver Creek and Box Elder Creek (flowing north to the Milk River east of Havre).

Water development through wells and springs is confined to livestock and domestic use.

At present there are an estimated 1,389 farm ponds, 110 irrigation storage reservoirs, 14 sprinkler and 86 surface irrigation systems of various sizes. There are 59,413 feet of irrigation canals with 763,021 lineal feet of field ditches. To date there are 2,962 acres of land leveled in the district.

FISH AND GAME

Fish

Hill County offers a wide variety of fishing opportunities. Streams draining the Bearpaw Mountains in that county offer excellent fishing for wild brook trout. Bearpaw Lake, constructed by the Fish and Game Commission, and numerous farm ponds, both public and private, offer good rainbow trout fishing. The Milk River below Fresno Reservoir provides some angling for walleye and sanger. Fresno Reservoir itself contains a fair population of Northern pike, although this reservoir is troubled by occasional severe drawdowns.

Game

Hill County affords a wide variety of vegetation and topography where many different species of game animals abound. In the prairie type, waterfowl are abundant. Two federal refuges attest to their importance in the County. Canada geese and many species of ducks are annually produced on these areas, Fresno Reservoir, and other smaller streams and reservoirs. The prairie type is also the home of antelope, deer, and sage grouse. The ringnecked pheasant inhabits the bottomlands of the Milk River and its tributaries, whereas the little Hungarian partridge is associated with the wheat-growing areas.

The Bearpaw Mountains in the southern part of the county are famed for their mule deer and whitetailed deer. In the foothills of this range is some of the finest sharptailed grouse hunting anywhere on the Hi-line.

Around 2,500 big game licenses are sold annually in Hill County. From this, one can see the importance of game animals in providing recreation to the people of the county.

With more people having more time to enjoy outdoor recreation, the game resource in Hill County will certainly assume even greater importance in the years ahead.

**SUMMARY OF IRRIGATED LAND BY RIVER BASINS IN THE
FOLLOWING COUNTIES COMPLETED TO DATE**

Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Deer Lodge, Fallon, Flathead,
Gallatin, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis & Clark, Lincoln, Madison,
Meagher, Missoula, Musselshell, Park, Pondera, Powder River, Powell, Ravalli, Rosebud, Silver
Bow, Stillwater, Sweet Grass, Teton, Treasure, Wheatland, Wibaux, and Yellowstone

RIVER BASIN	Present Irrigated Acres	Irrigable Acres Under Present Facilities	Maximum Irrigable Acres
Missouri Drainage Basin			
*Missouri River	109,660.50.....	25,290.33.....	134,950.83
Jefferson River	61,291.00.....	9,713.00.....	71,004.00
Beaverhead River	40,771.00.....	6,076.00.....	46,847.00
Big Hole River	23,775.00.....	1,950.00.....	25,725.00
Madison River	39,445.00.....	7,660.00.....	47,105.00
Gallatin River	112,054.00.....	21,242.00.....	133,296.00
Smith River	32,934.00.....	19,679.00.....	52,613.00
Sun River	124,474.58.....	4,385.00.....	128,859.58
Marias River	114,823.42.....	13,445.88.....	128,269.30
Teton River	74,653.00.....	15,882.33.....	90,535.33
Musselshell River	64,789.00.....	57,870.00.....	122,659.00
Milk River	79,688.00.....	21,220.33.....	100,908.33
Yellowstone River**	303,657.00.....	96,016.00.....	399,673.00
Stillwater River**	30,423.50.....	8,028.53.....	38,452.03
Clarks Fork River**	88,160.97.....	1,530.83.....	89,691.80
Big Horn River**	65,005.00.....	23,858.00.....	88,863.00
Tongue River	28,170.00.....	7,762.00.....	35,932.00
Powder River	35,948.00.....	2,299.00.....	38,247.00
Little Missouri River	42,513.00.....	1,499.00.....	44,012.00
Grand Total Missouri River Basin	1,472,235.97.....	345,407.23.....	1,817,643.20
Columbia River Drainage Basin			
Columbia River	0.....	0.....	0
Kootenai (Kootenay) River	9,914.13.....	968.00.....	10,882.13
Clark Fork (Deer Lodge) (Hellgate)			
(Missoula) River	146,287.70.....	14,934.20.....	161,221.90
Bitter Root River	111,102.43.....	3,200.00.....	114,302.43
Flathead River	135,907.19.....	4,532.22.....	140,439.41
Grand Total Columbia River Basin	403,211.45.....	23,634.42.....	426,845.87
GRAND TOTAL IN COUNTIES COMPLETED TO DATE	1,875,447.42.....	369,041.65.....	2,244,489.07

* Name of streams indented on the left-hand margin indicate that they are tributaries of the first stream named above which is not indented.

** Figures in these River Basins revised by resurvey of Carbon County, 1965.

IRRIGATION SUMMARY OF HILL COUNTY BY RIVER BASINS

MISSOURI RIVER BASIN	Present Irrigated Acres	Irrigable Acres Under Present Facilities	Maximum Irrigable Acres
*Missouri River	0.....	0.....	0
Marias River	12.00.....	30.00.....	42.00
Eight Mile Coulee	0.....	0.....	0
Unnamed Coulee	9.00.....	0.....	9.00
Black Coulee	0.....	0.....	0
Unnamed Coulee	7.00.....	0.....	7.00
East Black Coulee	40.00.....	0.....	40.00
Unnamed Coulee	70.00.....	0.....	70.00
Marias River and Tributaries	138.00.....	30.00.....	168.00
Milk River	1,551.00.....	350.00.....	1,901.00
Roundup (Simpson) Coulee	22.00.....	0.....	22.00
Spring Coulee	0.....	0.....	0
Unnamed Coulee	25.00.....	0.....	25.00
Bradbury Coulee	115.00.....	0.....	115.00
Dry Lake (Alkali) (Nine Mile) Coulee	0.....	0.....	0
Tommy Allen (Granite) (Sheep) Coulee	26.00.....	0.....	26.00
North Fork Nine Mile Coulee	80.00.....	0.....	80.00
Unnamed Coulee	20.00.....	0.....	20.00
Superneau (Black) Coulee	80.00.....	5.00.....	85.00
Big Sandy Creek	360.00.....	500.00.....	860.00
Box Elder Creek	422.00.....	1,004.00.....	1,426.00
Unnamed Coulee	22.00.....	0.....	22.00
Sage Creek	1,294.00.....	193.00.....	1,487.00
Russell Coulee	132.00.....	0.....	132.00
Unnamed Coulee	0.....	25.00.....	25.00
Flat (Pleasant Valley) (Stephens) Coulee	16.00.....	232.00.....	248.00
O'Brien Coulee	22.00.....	83.00.....	105.00
Hingham Coulee	0.....	0.....	0
Unnamed Coulee	3.00.....	0.....	3.00
Sage Lake Coulee	30.00.....	0.....	30.00
Unnamed Coulee	8.00.....	0.....	8.00
Sage Creek and Tributaries	1,505.00.....	533.00.....	2,038.00
Browns Coulee	68.00.....	31.00.....	99.00
O'Brien (Schwartz) (Deadhorse) Coulee	12.00.....	0.....	12.00
Carvel (Gravelly) (Grave) Creek	244.00.....	0.....	244.00
Unnamed Coulee	15.00.....	0.....	15.00
Spring (Dry Creek) Coulee	143.00.....	0.....	143.00
Herron Coulee	28.00.....	0.....	28.00
Unnamed Spring Coulee	12.00.....	0.....	12.00
Unnamed Coulee	10.00.....	0.....	10.00

* Names of streams indented on the left-hand margin indicate that they are tributaries of the first stream named above which is not indented.

IRRIGATION SUMMARY OF HILL COUNTY BY RIVER BASINS

MISSOURI RIVER BASIN—(Continued)	Present Irrigated Acres	Irrigable Acres Under Present Facilities	Maximum Irrigable Acres
Conner Coulee	55.00.....	50.00.....	105.00
Neuwerth Coulee	0.....	20.00.....	20.00
Sprinkle (Johnson) Coulee	9.00.....	0.....	9.00
Unnamed Coulee	15.00.....	0.....	15.00
Well	14.00.....	6.00.....	20.00
Big Sandy Creek and Tributaries	2,934.00.....	2,144.00.....	5,078.00
Beaver Creek	1,217.00.....	633.00.....	1,850.00
Unnamed Coulee	12.00.....	8.00.....	20.00
Rocky Hock Creek	0.....	0.....	0
Upper Rocky Hock Creek	22.00.....	9.00.....	31.00
Unnamed Coulee	23.00.....	0.....	23.00
Springdale Coulee	28.00.....	0.....	28.00
Alkali Lake	20.00.....	0.....	20.00
Wells	59.00.....	0.....	59.00
Squaw Coulee	150.00.....	0.....	150.00
Beaver Creek and Tributaries	1,531.00.....	650.00.....	2,181.00
Bull Hook Coulee	75.00.....	0.....	75.00
Unnamed Coulee	38.00.....	0.....	38.00
Young Creek	0.....	11.00.....	11.00
Coal Mine Coulee	11.00.....	10.00.....	21.00
Box Elder Creek	915.00.....	225.00.....	1,140.00
Des Rosier Creek	63.00.....	0.....	63.00
Red Rock Coulee	0.....	0.....	0
Black (Lohman) Coulee	439.00.....	0.....	439.00
Unnamed Coulee	35.00.....	0.....	35.00
Sage Creek	1,365.00.....	0.....	1,365.00
Unnamed Coulee	33.00.....	0.....	33.00
Lodge Creek	89.00.....	18.00.....	107.00
Unnamed Coulee	33.00.....	0.....	33.00
Greenman Coulee	210.00.....	0.....	210.00
Milk River and Tributaries	9,690.00.....	3,413.00.....	13,103.00
GRAND TOTAL FOR HILL COUNTY	9,828.00.....	3,443.00.....	13,271.00

HAVRE IRRIGATION COMPANY

HISTORY

The Havre Irrigation Company was incorporated on August 15, 1903 for a 20-year period. The company renewed its Articles of Incorporation on January 1, 1927 for a term of 40 years; these articles will expire January 1, 1967. The amount of capital stock in the corporation is \$20,000 divided into 20,000 shares with a par value of \$1.00 each. Present subscribed company stock totals 12,630 shares.

Original incorporators in the company were John W. Clack, Thad F. Raymond, Ray L. Sands, Philip D. Clack, and Lulu M. Raymond. John W. Clack, Ray L. Sands and others filed the first water right for the Havre Irrigation Company from Beaver Creek on December 9, 1901. Additional water filings were made by the company in 1903 and 1904. On July 19, 1954, when Beaver Creek was adjudicated, the Havre Irrigation Company was given the first right on this stream (see water right data).

PRESENT STATISTICS

Location: Land irrigated by the Havre Irrigation Company is located in Sections 7, 17, and 18, T. 32N., R. 16E.; Sections 11-14 inclusive, 22, 23, 24, 26, 27, 28, and 33, T. 32N., R. 15E. Point of diversion of the main canal from Beaver Creek is in the NW¼NE¼ of Section 33, T. 32N., R. 15E.

Length and Capacity of Canal: The initial capacity of the Havre Irrigation Company Canal is 60 c.f.s. and is about five miles in length to Sands Lake where it ends. From Sands Lake another ditch of a smaller capacity of about 20 c.f.s. extends in an easterly direction for a distance of about two miles. Sands Lake, a storage reservoir for the Havre Irrigation Company, has a usable capacity of 300 acre-feet; and it has a surface area of approximately 95 acres.

Operation and Maintenance: When assessments are made for operation and maintenance of this irrigation system, they are 5¢ per share of stock owned by members of the company. These assessments are not regular each year, and are made only when necessary.

Present Users: As of the year 1966 there were 19 water users (members) in the Havre Irrigation Company owning a combined total of 12,630 shares of stock.

Acreage Irrigated: Acres irrigated in 1966 were 1,059 acres with 578 acres potentially irrigable under present facilities.

WATER RIGHT DATA

The Havre Irrigation Company has the first decreed right out of Beaver Creek with the date of priority listed as December 9, 1901, and the amount being 2,384.8 miner's inches or 59.62 c.f.s. of water. (Reference: Beaver Creek Decree, Case No. 10426, dated July 19, 1954, Clerk of Court's Office, Hill County, Montana.)

(See maps in Part II, pages 16 and 17.)

WATER RIGHT DATA—HILL COUNTY

APPROPRIATIONS AND DECREES BY STREAMS

APPROPRIATIONS (Filings of Records)							
STREAM	No. of Filings	Miner's Inches	Cu. Ft. Per Sec.	Case No.	No. of Decrees	Miner's Inches	Cu. Ft. Per Sec.
MISSOURI RIVER BASIN							
*Missouri River	0.....	0.....	0.....				
Marias River	1.....	120.00.....	3.00.....				
Unnamed Coulee	1.....	160.00.....	4.00.....				
Eight Mile Coulee	2.....	80.00.....	2.00.....				
Unnamed Coulee	1.....	40.00.....	1.00.....				
Black Coulee	5.....	948.00.....	23.70.....				
Backstrom Coulee	1.....	400.00.....	10.00.....				
Rocky Coulee	2.....	1,520.00.....	38.00.....				
Unnamed Coulee	1.....	400.00.....	10.00.....				
East Black Coulee	1.....	200.00.....	5.00.....				
Unnamed Coulee	2.....	1,520.00.....	38.00.....				
Flat Coulee	3.....	760.00.....	19.00.....				
Marias River and Tributaries ..	20.....	6,148.00.....	153.70.....				
Birch Creek	2.....	160.00.....	4.00.....				
Unnamed Spring	1.....	40.00.....	1.00.....				
Unnamed Tributary	2.....	120.00.....	3.00.....				
Spring	1.....	80.00.....	2.00.....				
East Fork Birch Creek	3.....	180.00.....	4.50.....				
Unnamed Tributaries ..	2.....	120.00.....	3.00.....				
Spring	1.....	60.00.....	1.50.....				
Fremming Creek ..	1.....	200.00.....	5.00.....				
Birch Creek and Tributaries	13.....	960.00.....	24.00.....				
Milk River	13.....	1,218,440.00.....	30,461.00.....				
Barrow Coulee	1.....	80.00.....	2.00.....				
Canadian Coulee	0.....	0.....	0.....				
Unnamed Coulee	1.....	400.00.....	10.00.....				
Lost River	2.....	200.00.....	5.00.....				
Geddes Coulee	1.....	400.00.....	10.00.....				
Sahara Coulee	1.....	400.00.....	10.00.....				
Roundup (Simpson) Coulee	3.....	11,240.00.....	281.00.....				
Spring Coulee	5.....	820.00.....	20.50.....				
Bradbury Coulee	1.....	2,500.00.....	62.50.....				
Little Sage Creek	1.....	100.00.....	2.50.....				
Dry Lake (Alkali) (Nine Mile) Coulee	3.....	1,160.00.....	29.00.....				
Tommy Allen (Granite) (Sheep) Coulee	4.....	1,500.00.....	37.50.....				
North Fork Nine Mile Coulee	6.....	24,620.00.....	615.50.....				
Unnamed Coulee	1.....	49,920.00.....	1,248.00.....				
Long Coulee Reservoir ..	1.....	320.00.....	8.00.....				
Chain of Lakes Coulee ..	1.....	240.00.....	6.00.....				
Unnamed Coulee	1.....	All.....	.....			
Wild Rose Coulee	2.....	1,200.00.....	30.00.....				
Alkali Lake Coulee	0.....	0.....	0.....				
Crossons Coulee	1.....	400.00.....	10.00.....				
Alkali Coulee	2.....	200.00.....	5.00.....				
Watson Coulee	1.....	400.00.....	10.00.....				
Browns Coulee	1.....	200.00.....	5.00.....				

* Names of streams indented on the left-hand margin indicate that they are tributaries of the first stream named above which is not indented.

WATER RIGHT DATA—HILL COUNTY

APPROPRIATIONS AND DECREES BY STREAMS

APPROPRIATIONS (Filings of Records)

STREAM	No. of Filings	Miner's Inches	Cu. Ft. Per Sec.	Case No.	No. of Decrees	Miner's Inches	Cu. Ft. Per Sec.
Flat (Stowell) Coulee	2	160.00	4.00				
Flag Coulee	1	400.00	10.00				
Eagle Coulee	1	200.00	5.00				
Nelson Coulee	7	2,000,000.00	50,000.00				
Sheehan Coulee	1	200.00	5.00				
Unnamed Coulee	0	0	0				
Grassy Springs	1	350.00	8.75				
Superneau (Black) Coulee	3	1,100.00	27.50				
Unnamed Coulee	1	400.00	10.00				
Fresno Coulee	3	2,800.00	70.00				
Big Sandy Creek	22	14,175.00	354.38				
Twelve Mile Coulee	0	0	0				
Ben Ryan Coulee	2	380.00	9.50				
Barneys Coulee	2	9,532.00	238.30				
Unnamed Coulee	0	0	0				
Jones Reservoir	1	200.00	5.00				
Unnamed Coulee	1	1,600.00	40.00				
Jerome Coulee	1	200.00	5.00				
Van Alstine Reservoir	1	200.00	5.00				
Box Elder Creek	16	7,340.00	183.50	*1553	5	830.00	20.75
Brown Coulee	1	200.00	5.00				
Square Butte Lake	1	200.00	5.00				
Denley Coulee	1	40.00	1.00				
Sayer Spring	1	200.00	5.00				
Herzog Coulee	3	360.00	9.00				
Browns Coulee	1	500.00	12.50				
Sage Creek	43	195,210.00	4,880.25				
Strode (Berlina) Coulee	3	2,800.00	70.00				
Russell Coulee	4	3,600.00	90.00				
Unnamed Coulee	2	3,000.00	75.00				
Kennedy Lake	1	400.00	10.00				
Flat (Pleasant Valley) (Stephens) Coulee	4	160,780.00	4,019.50				
Miranda Coulee	6	8,800.00	220.00				
Schultz Coulee	1	600.00	15.00				
Little Sage Creek	19	4,480.00	112.00				
Scotch Coulee	2	80.00	2.00				
Cicon Coulee	1	400.00	10.00				
Big Coulee	4	880.00	22.00				
Tootsie Creek	1	200.00	5.00				
Magnum Reservoir	3	1,800.00	45.00				
O'Brien Creek	9	8,180.00	204.50				
Hingham Coulee	2	900.00	22.50				
Unnamed Spring	1	10.00	0.25				
Sage Lake Coulee	1	400.00	10.00				
Sage Lake	2	400.00	10.00				
Halfway Coulee	2	160.00	4.00				
Sage Creek and Tributaries	111	393,080.00	9,827.00				
Cowan Reservoir	1	320.00	8.00				
Browns Coulee	1	80.00	2.00				
Sand (Sheep) Creek	4	520.00	13.00				

* Clerk of Court, Fort Benton, Montana

WATER RIGHT DATA—HILL COUNTY

APPROPRIATIONS AND DECREES BY STREAMS

STREAM	APPROPRIATIONS (Filings of Records)				Case No.	No. of Decrees	Miner's Inches	Cu. Ft. Per Sec.
	No. of Filings	Miner's Inches	Cu. Ft. Per Sec.					
Sheep Shed Coulee ..	1.....	1,000.00.....	25.00.....					
Dry Fork (Green) Coulee	3.....	440.00.....	11.00.....					
Middle Coulee	1.....	200.00.....	5.00.....					
O'Brien (Schwartz) (Deadhorse) Coulee ..	4.....	8,985.00.....	224.63.....					
Carvel (Gravelly) (Grave) Creek	12.....	13,040.00.....	326.00.....					
South Fork Gravelly Coulee	1.....	80.00.....	2.00.....					
Spring (Dry Creek) Coulee	5.....	104,720.00.....	2,618.00.....					
Herron Coulee	1.....	400.00.....	10.00.....					
Unnamed Coulee	1.....	1,200.00.....	30.00.....					
Conner Coulee	1.....	400.00.....	10.00.....					
Unnamed Coulee	3.....	500.00.....	12.50.....					
Unnamed Coulee	1.....	All.....	—.....					
Neuwerth Coulee	3.....	400.00.....	10.00.....					
Sprinkle (Johnson) Coulee	4.....	800.00.....	20.00.....					
Hatler Coulee	1.....	160.00.....	4.00.....					
Beedy Coulee	1.....	160.00.....	4.00.....					
Unnamed Coulee	1.....	3,960.00.....	99.00.....					
Well	1.....	17.80.....	0.45.....					
Big Sandy Creek and Tributaries	216.....	565,589.80.....	14,139.76.....					
Neal Coulee	1.....	200.00.....	5.00.....					
Coal Mine (Rattlesnake) Coulee	1.....	150.00.....	3.75.....					
Spokane (Meili) Coulee ..	2.....	400.00.....	10.00.....					
Harroun Coulee	1.....	400.00.....	10.00.....					
Sweets Coulee	1.....	140.00.....	3.50.....					
Deep Coulee	1.....	140.00.....	3.50.....					
Beaver Creek	26.....	23,645.00.....	591.13.....	10426	5.....	2,724.80.....	68.12	
Sucker Creek	2.....	320.00.....	8.00.....					
Unnamed Tributary	1.....	80.00.....	2.00.....					
Waxon Coulee	1.....	80.00.....	2.00.....					
Unnamed Tributary	1.....	200.00.....	5.00.....					
Revie Creek	1.....	120.00.....	3.00.....					
Unnamed Coulee	1.....	200.00.....	5.00.....					
Rocky Hook Creek	1.....	20.00.....	0.50.....					
Upper Rocky Hook Creek	1.....	400.00.....	10.00.....					
Wilsons Coulee	1.....	80.00.....	2.00.....					
Springdale Creek	2.....	400.00.....	10.00.....					
Well	1.....	1.80.....	0.05.....					
Alkali Lake	1.....	4,000.00.....	100.00.....					
Choquette Lake	1.....	4,000.00.....	100.00.....					
Wells	3.....	60.20.....	1.51.....					
Squaw Coulee	5.....	7,160.00.....	179.00.....					
Reservation Coulee ..	1.....	300.00.....	7.50.....					
Squaw Butte Spring	3.....	505.00.....	12.63.....					
Develin Coulee	1.....	400.00.....	10.00.....					
Spring	1.....	120.00.....	3.00.....					
Beaver Creek and Tributaries ..	55.....	42,092.00.....	1,052.32.....					

WATER RIGHT DATA—HILL COUNTY

APPROPRIATIONS AND DECREES BY STREAMS

APPROPRIATIONS (Filings of Records)

STREAM	No. of Filings	Miner's Inches	Cu. Ft. Per Sec.	Case No.	No. of Decrees	Miner's Inches	Cu. Ft. Per Sec.
Bad Land Coulee	1.....	250.00.....	6.25.....				
Drain Ditch	1.....	20.00.....	0.50.....				
Bull Hook Coulee	17.....	3,534.00.....	88.35.....				
Spring Coulee	1.....	200.00.....	5.00.....				
Jordan Coulee	1.....	100.00.....	2.50.....				
Double (Spring) Coulee	2.....	200.00.....	5.00.....				
Wade Coulee	1.....	160.00.....	4.00.....				
Hobbs Ravine (Broadwater Coulee)	2.....	400.00.....	10.00.....				
Youngs Creek	2.....	560.00.....	14.00.....				
Unnamed Coulee	0.....	0.....	0.....				
Crystal Springs	1.....	1,000.00.....	25.00.....				
Gorman Coulee	1.....	320.00.....	8.00.....				
Spring	1.....	500.00.....	12.50.....				
MacFarlane Coulee	1.....	400.00.....	10.00.....				
Dry (Morris) Coulee	3.....	800.00.....	20.00.....				
Scott (Swantons) Coulee	2.....	800.00.....	20.00.....				
Bull Hook Coulee and Tributaries	35.....	8,974.00.....	224.35.....				
Saddle Butte (Packsaddle) Coulee ..	2.....	5,240.00.....	131.00.....				
East Saddle Butte (Nort) Coulee	3.....	960.00.....	24.00.....				
Coal Mine Coulee	1.....	240.00.....	6.00.....				
Sheep Camp Coulee	3.....	1,200.00.....	30.00.....				
Carnal (Mays) Coulee	2.....	240.00.....	6.00.....				
Box Elder (Little Box Elder) Creek	41.....	15,840.00.....	396.00.....				
West Fork Box Elder Creek	1.....	100.00.....	2.50.....				
Allens Coulee	1.....	400.00.....	10.00.....				
Couch Coulee	1.....	200.00.....	5.00.....				
Unnamed Coulee	1.....	80.00.....	2.00.....				
Faber Coulee	1.....	80.00.....	2.00.....				
Gagne Coulee	2.....	240.00.....	6.00.....				
Hill Coulee	1.....	40.00.....	1.00.....				
Unnamed Coulee	2.....	100.00.....	2.50.....				
Unnamed Coulee	1.....	20.00.....	0.50.....				
Prudens Coulee	1.....	40.00.....	1.00.....				
Unnamed Coulee	1.....	80.00.....	2.00.....				
Des Rosier Coulee	1.....	400.00.....	10.00.....				
Half Breed Coulee	2.....	400.00.....	10.00.....				
Unnamed Coulee	0.....	0.....	0.....				
Spring	1.....	100.00.....	2.50.....				
Unnamed Coulee	0.....	0.....	0.....				
Spring	1.....	All.....	--.....				
Unnamed Coulee	1.....	200.00.....	5.00.....				
Henrys Basin Coulee ..	4.....	850.00.....	21.25.....				
Spring	1.....	300.00.....	7.50.....				
Spring Coulee	1.....	150.00.....	3.75.....				
War Bonnet (Porcupine Hollow) Coulee	2.....	250.00.....	6.25.....				
War Bonnet (Porcu- pine Hollow) Springs	2.....	300.00.....	7.50.....				

WATER RIGHT DATA—HILL COUNTY

APPROPRIATIONS AND DECREES BY STREAMS

APPROPRIATIONS (Filings of Records)

STREAM	No. of Filings	Miner's Inches	Cu. Ft. Per Sec.	Case No.	No. of Decrees	Miner's Inches	Cu. Ft. Per Sec.
Unnamed Coulee	0.....	0.....	0.....				
Spring	1.....	240.00.....	6.00.....				
Sheep Corral Coulee ..	3.....	600.00.....	15.00.....				
Unnamed Coulee	1.....	80.00.....	2.00.....				
Grass Coulee	3.....	760.00.....	19.00.....				
Niles Coulee	2.....	440.00.....	11.00.....				
Daveys Coulee	1.....	200.00.....	5.00.....				
School Section Coulee ..	1.....	80.00.....	2.00.....				
Mudhole Coulee	2.....	600.00.....	15.00.....				
Unnamed Coulees	1.....	100.00.....	2.50.....				
Spring	1.....	200.00.....	5.00.....				
Staton Coulee	2.....	2,000.00.....	50.00.....				
Grampas & Mildreds Coulee	2.....	440.00.....	11.00.....				
Flag Pole Coulee	1.....	200.00.....	5.00.....				
McIntyer Spring (One Tree) Coulee ..	3.....	1,320.00.....	33.00.....				
Unnamed Spring	1.....	100.00.....	2.50.....				
Unnamed Coulee	2.....	400.00.....	10.00.....				
Box Elder Creek and Tributaries	97.....	27,930.00.....	698.25.....				
Clear Creek	0.....	0.....	0.....				
White Pine Creek	2.....	440.00.....	11.00.....				
Bennett Coulee	1.....	30.00.....	0.75.....				
Unnamed Coulee	1.....	80.00.....	2.00.....				
K. Lowrey Coulee	2.....	420.00.....	10.50.....				
Grass Coulee	1.....	400.00.....	10.00.....				
Wilbur Coulee	2.....	800.00.....	20.00.....				
Rices Coulee	1.....	400.00.....	10.00.....				
Rushs Coulee	1.....	300.00.....	7.50.....				
Red Rock Coulee	3.....	1,600.00.....	40.00.....				
Connolly Coulee	1.....	400.00.....	10.00.....				
Garske Coulee	2.....	800.00.....	20.00.....				
Stations (Willow) Coulee	5.....	3,300.00.....	82.50.....				
Brownes Coulee	1.....	600.00.....	15.00.....				
Black (Lohman) Coulee	6.....	3,400.00.....	85.00.....				
Sage Creek	11.....	4,080.00.....	102.00.....	9724	2.....	2,840.00.....	71.00
Grassy Lake	2.....	960.00.....	24.00.....				
Lone Tree Coulee	2.....	275.00.....	6.88.....				
Boundary Line Coulee	2.....	200.00.....	5.00.....				
Unnamed Coulee ..	1.....	20,000.00.....	500.00.....				
Marietta Coulee ..	1.....	40.00.....	1.00.....				
Black Butte Coulee ..	1.....	400.00.....	10.00.....				
Signal Coulee	1.....	All.....	-----				
Lake Bed	1.....	100.00.....	2.50.....				
Lake	1.....	-----	-----				
Unnamed Coulee ..	1.....	4,000.00.....	100.00.....				
Thibeaudeau Coulee ..	2.....	1,003.00.....	25.08.....				
Lake	4.....	-----	-----				
Lake	3.....	-----	-----				
Spring Coulee	1.....	200.00.....	5.00.....				
Coal Coulee	3.....	1,380.00.....	34.50.....				
Red Rock Coulee and Tributaries	55.....	42,738.00.....	1,068.46.....				

WATER RIGHT DATA—HILL COUNTY
APPROPRIATIONS AND DECREES BY STREAMS

APPROPRIATIONS (Filings of Records)							
STREAM	No. of Filings	Miner's Inches	Cu. Ft. Per Sec.	Case No.	No. of Decrees	Miner's Inches	Cu. Ft. Per Sec.
Lodge Creek (West Fork Milk River)	5.....	25,560.00.....	638.50.....				
Greenman (Creedman) Coulee	8.....	30,452.00.....	761.30.....				
Stony Lake	1.....	160.00.....	4.00.....				
South Fork Green- man Coulee	2.....	480.00.....	12.00.....				
Kahn Coulee	1.....	200.00.....	5.00.....				
Unnamed Coulee	1.....	2,000.00.....	50.00.....				
Unnamed Coulee	1.....	800.00.....	20.00.....				
Battle Creek (North Fork Milk River)	0.....	0.....	0.....				
Wood Pile Coulee	0.....	0.....	0.....				
Antelope Coulee	2.....	288,000.00.....	7,200.00.....				
Unnamed Spring	1.....	80.00.....	2.00.....				
Milk River and Tributaries	584.....	4,367,835.80.....	109,195.94.....		12.....	6,394.80.....	159.87
GRAND TOTAL FOR HILL COUNTY	617.....	4,374,943.80.....	109,373.64.....		12.....	6,394.80.....	159.87

DRAINAGES IN HILL COUNTY NOT LOCATED

STREAM	No. of Filings	Miner's Inches	Cu. Ft. Per Sec.
Carles Coulee	1.....	80	2.00
Grace Coulee	1.....	100	2.50
Long Coulee	1.....	320	8.00
O'Neal Coulee	1.....	400	10.00
N Ranch Coulee	1.....	200	5.00
Sprague Creek	1.....	160	4.00
Spring Creek	4.....	660	16.50
Stewart Coulee	2.....	300.2.....	7.50
Tomahawk Creek	1.....	100	2.50
Wades Coulee	1.....	10	0.25
Unnamed Coulee	1.....	400	10.00
TOTAL	15	2,730.2	68.25

WATER RESOURCES SURVEY

Hill County, Montana

PART II

Maps Showing Irrigated Areas

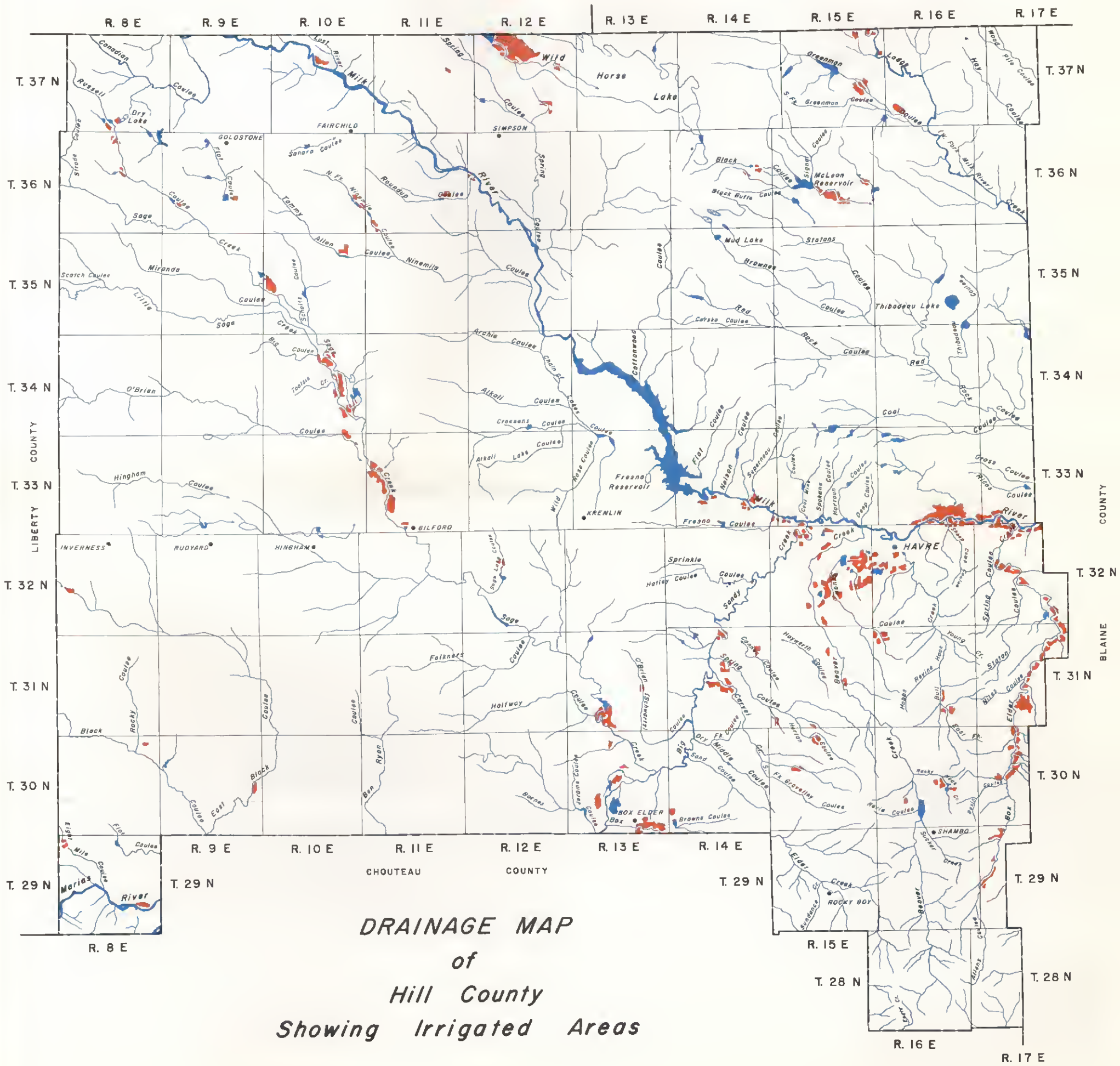
Published by
STATE WATER CONSERVATION BOARD
Helena, Montana
June, 1967

MAP INDEX

Township	Range	Page	Township	Range	Page
29 North	8 East.....	1	33 North	11 East.....	20
29 North	17 East.....	2	33 North	14 East.....	21
30 North	8 East.....	3	33 North	15 East.....	16
30 North	9 East.....	3	33 North	16 East.....	22
30 North	13 East.....	4	33 North	17 East.....	18
30 North	14 East.....	4	34 North	10 East.....	19
30 North	15 East.....	5	35 North	10 East.....	23
30 North	16 East.....	6	36 North	8 East.....	24
30 North	17 East.....	7	36 North	9 East.....	25
31 North	13 East.....	8	36 North	10 East.....	26
31 North	14 East.....	9	36 North	11 East.....	27
31 North	15 East.....	10	36 North	12 East.....	27
31 North	16 East.....	11	36 North	14 East.....	28
31 North	17 East.....	12	36 North	15 East.....	29
32 North	8 East.....	13	37 North	8 East.....	24
32 North	12 East.....	14	37 North	10 East.....	30
32 North	14 East.....	15	37 North	11 East.....	31
32 North	15 East.....	16	37 North	12 East.....	32
32 North	16 East.....	17	37 North	15 East.....	33
32 North	17 East.....	18	37 North	16 East.....	33
33 North	10 East.....	19			

ALL MAPS HAVE BEEN MADE FROM AERIAL PHOTOGRAPHS.

DOMINION OF CANADA
ALBERTA SASKATCHEWAN



MAP SYMBOL INDEX

BOUNDARIES

----- COUNTY LINE

----- NATIONAL FOREST LINE

DITCHES

~ CANALS OR DITCHES

---> DRAIN DITCHES

- - - -> PROPOSED DITCHES

STRUCTURES & UNITS

\ DAM

~ DIKE

~ FLUME

~ SIPHON

~ SPILL

☆ SPRINKLER SYSTEM

~ WEIR

~ PIPE LINE

● PUMP

○ PUMP SITE

~ RESERVOIR

⊕ WELL

+ + + NATURAL CARRIER USED AS DITCH

TRANSPORTATION

== PAVED ROADS

=== UNPAVED ROADS

+++ RAILROADS

10 STATE HIGHWAY

19 U.S. HIGHWAY

◇ AIRPORT

* SPRING

⬇ SWAMP

⊕ GAUGING STATION

■ POWER PLANT

● STORAGE TANK

⊠ CEMETERY

○ FAIRGROUND

■ FARM OR RANCH UNIT

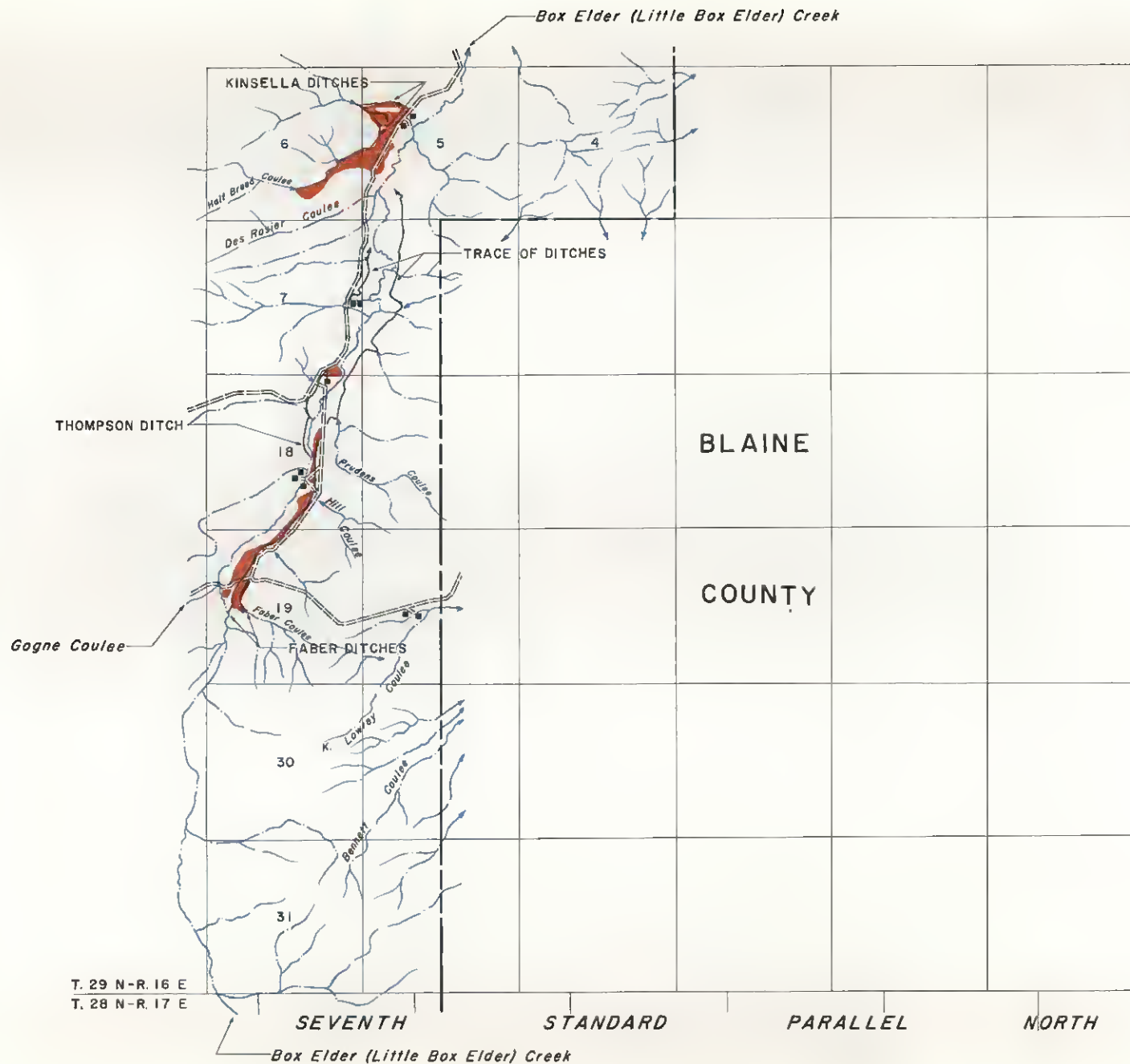
⬆ LOOKOUT STATION

⬆ RANGER STATION


~ RAILROAD TUNNEL

⬆ SCHOOL

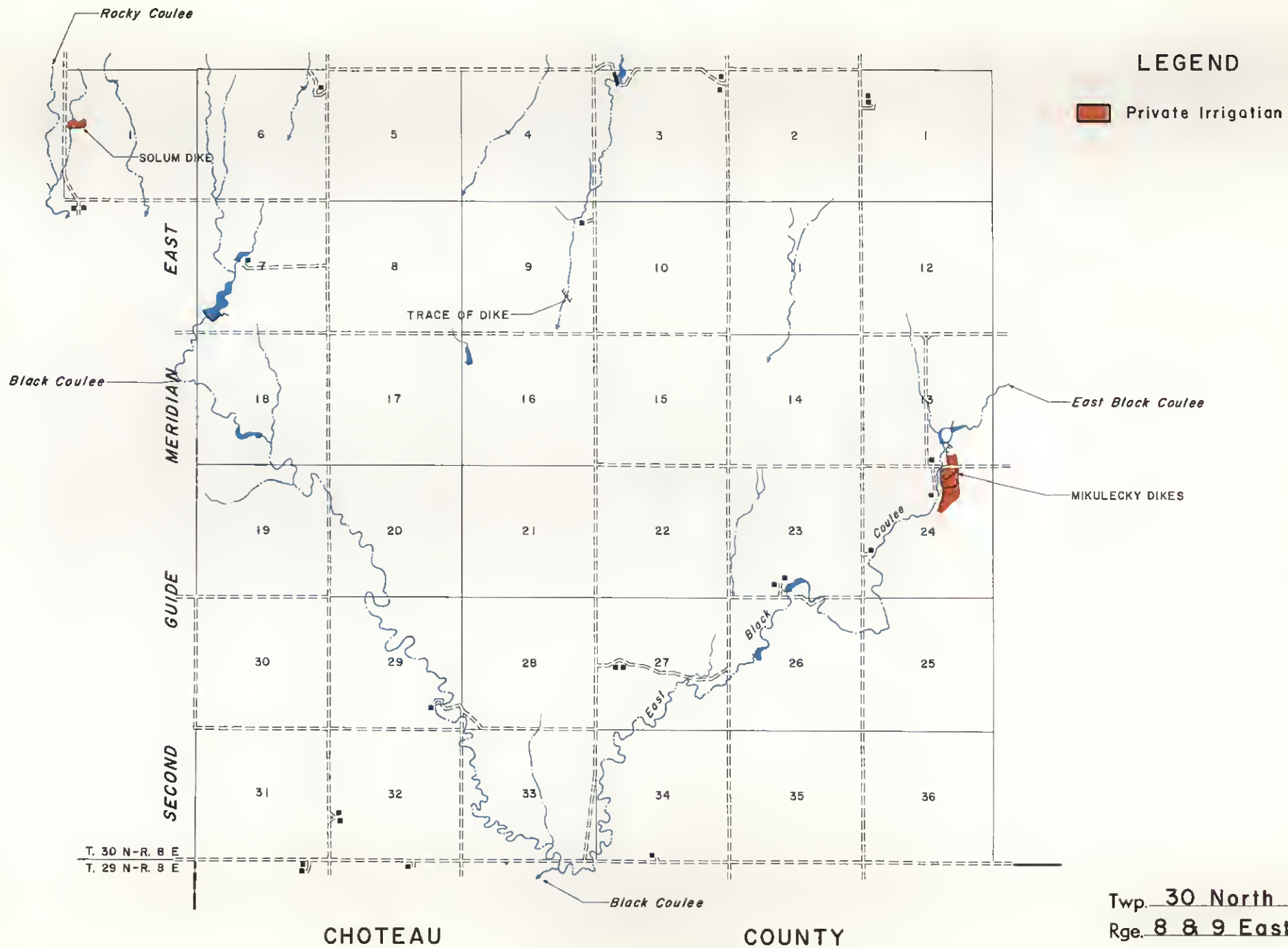
⋈ SHAFT, MINE, OR DRIFT



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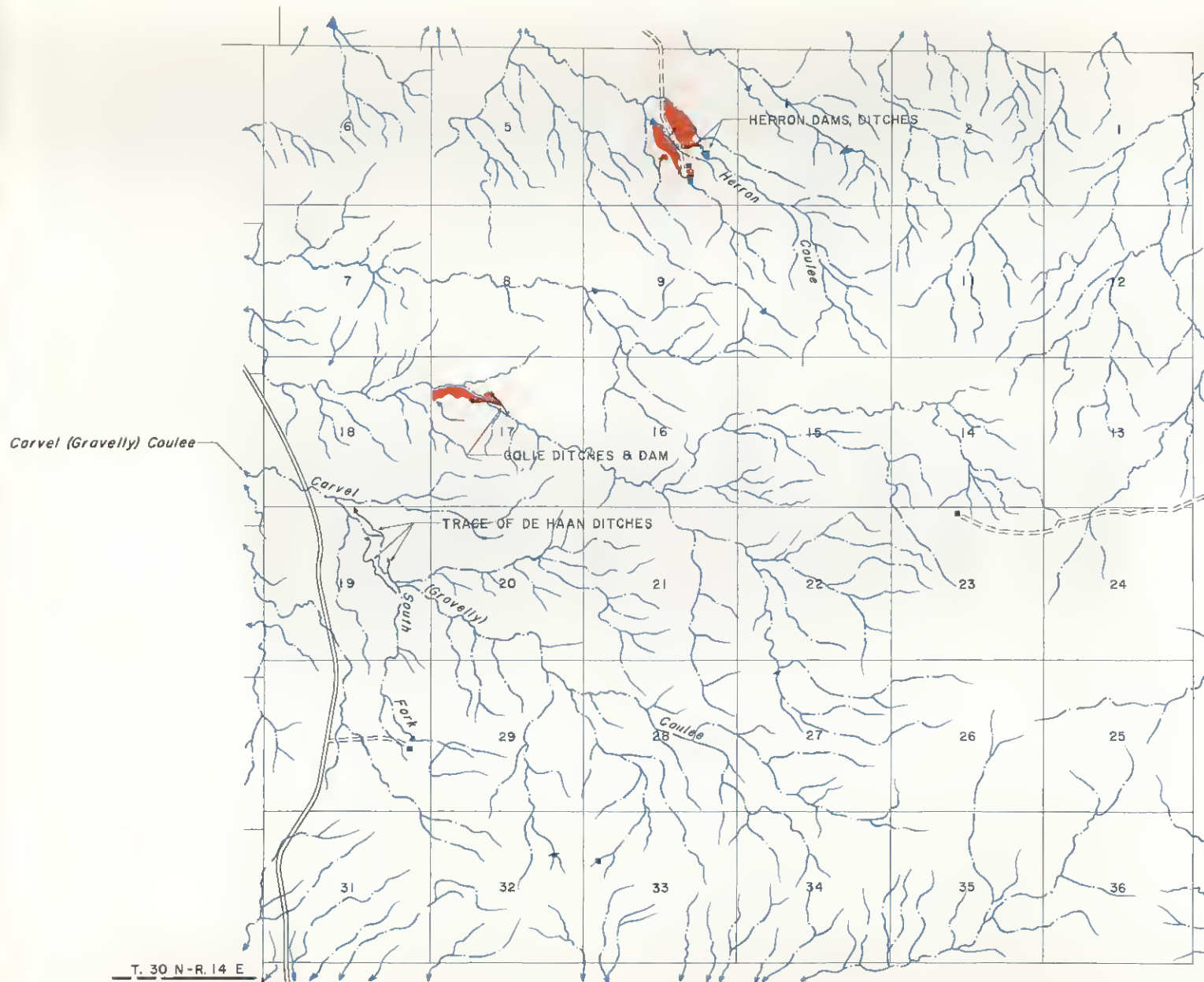
 Private Irrigation

Tw. 29 North
Rge. 17 East



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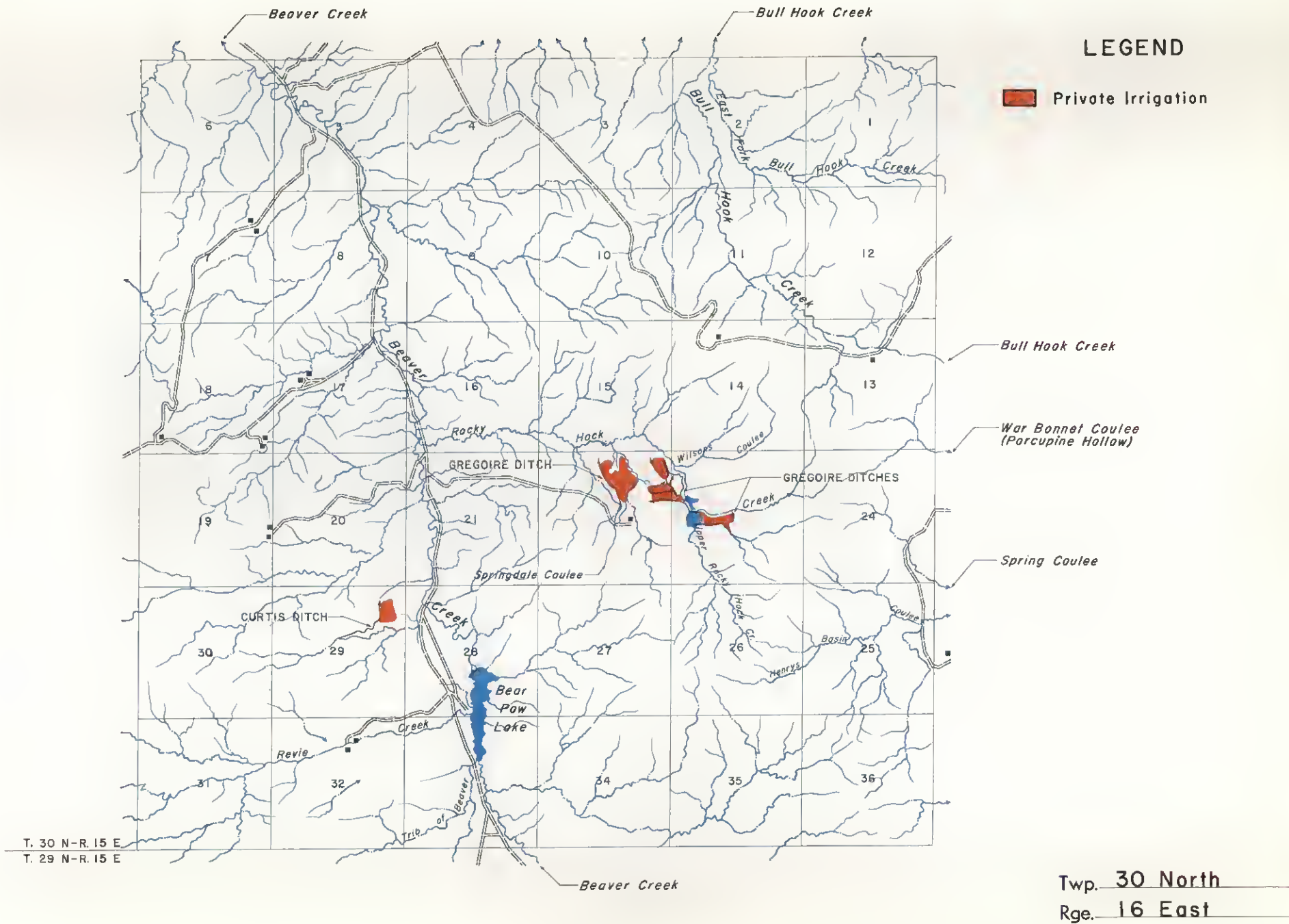
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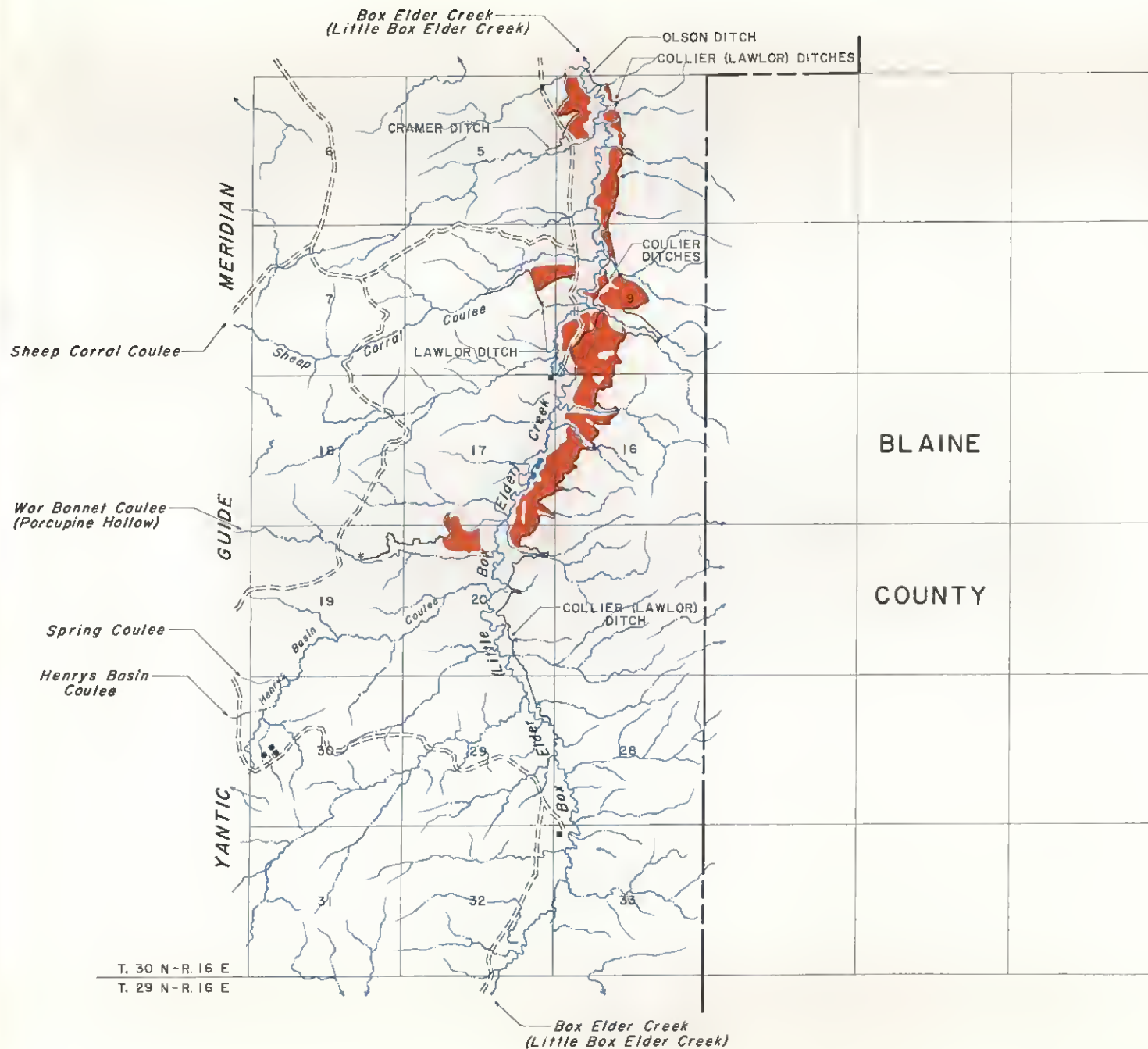


T. 30 N-R. 14 E
T. 29 N-R. 14 E

CHOUTEAU
COUNTY

Twp. 30 North
Rge. 15 East

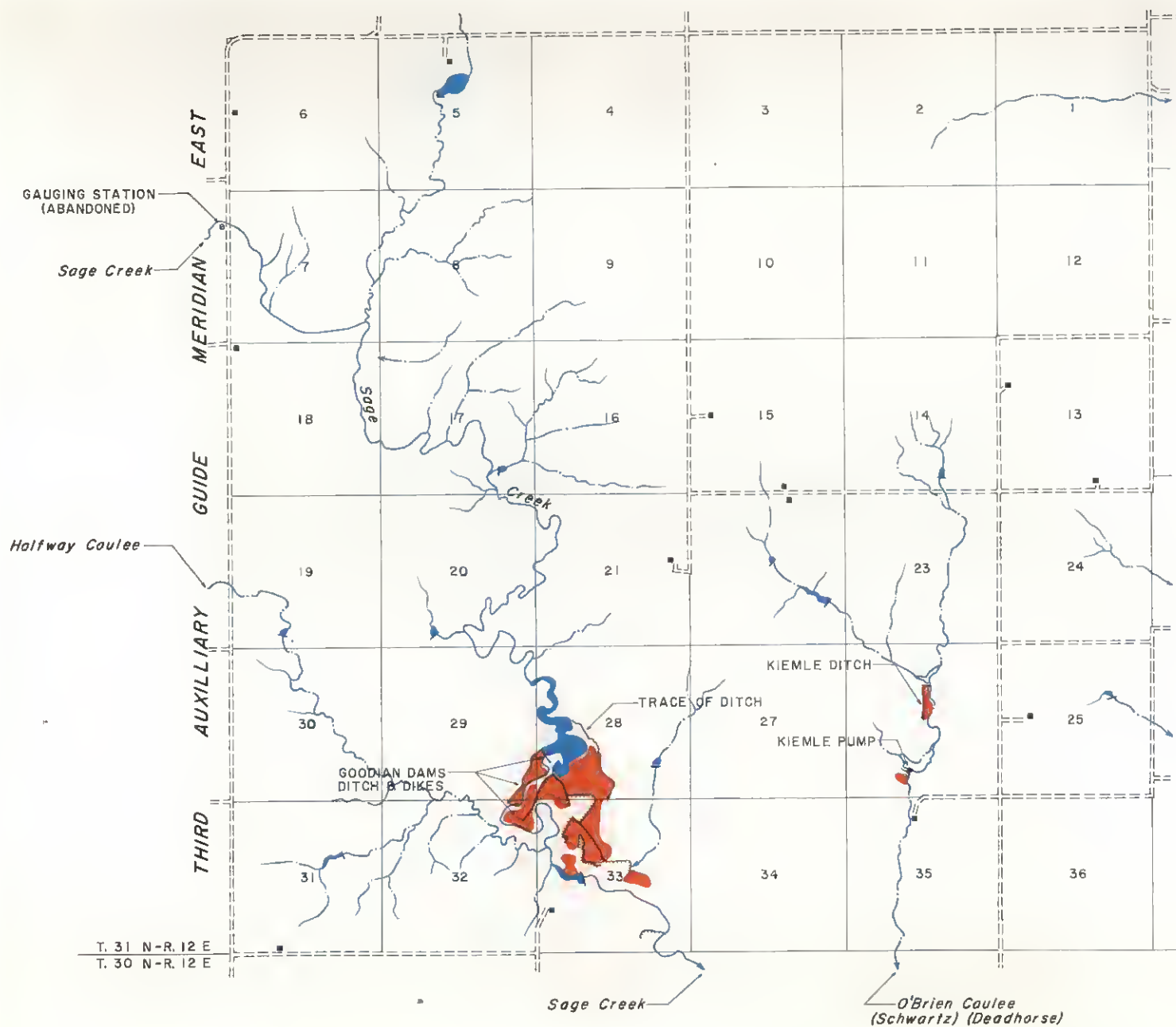




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Private Irrigation

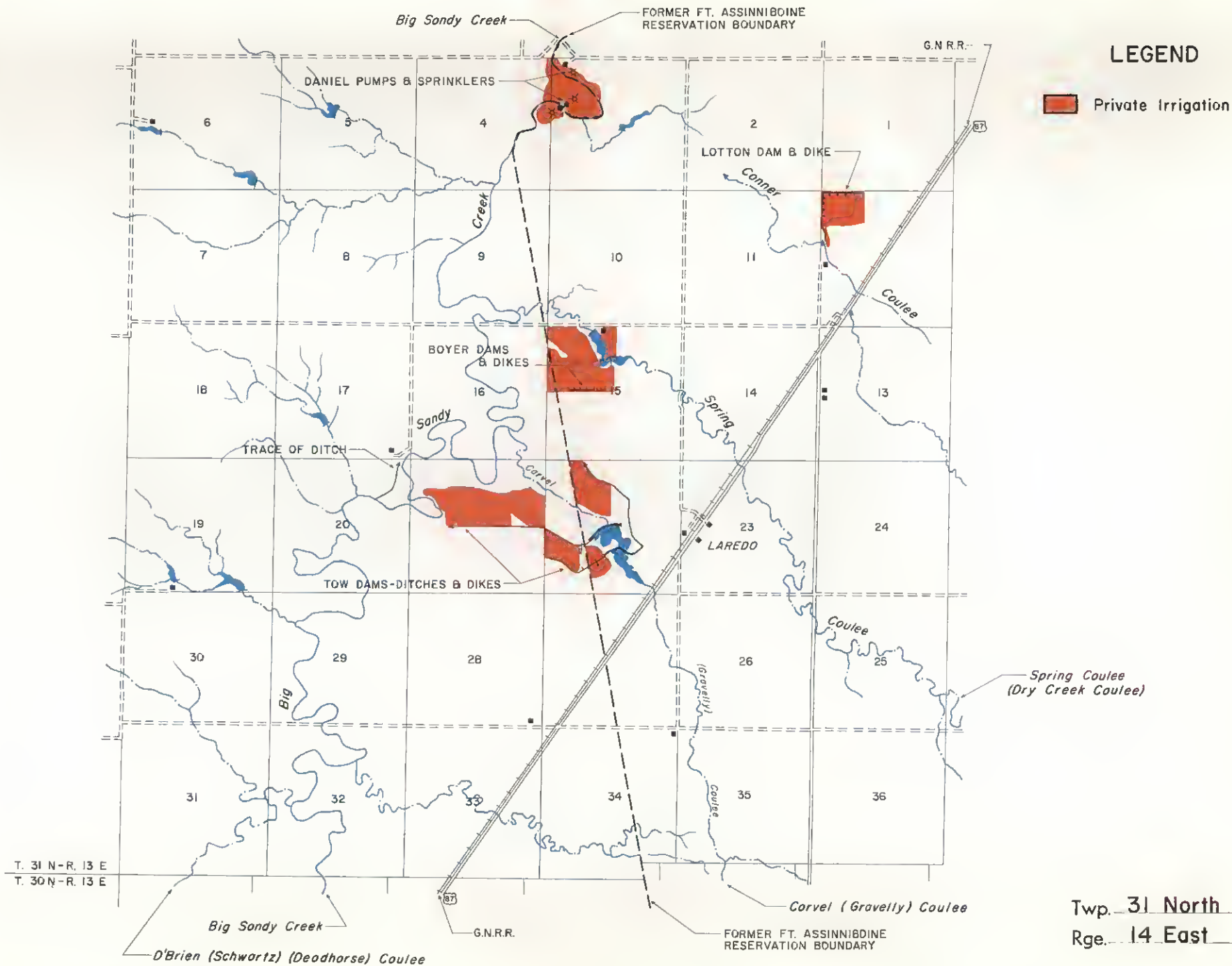
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Rge. 17 East

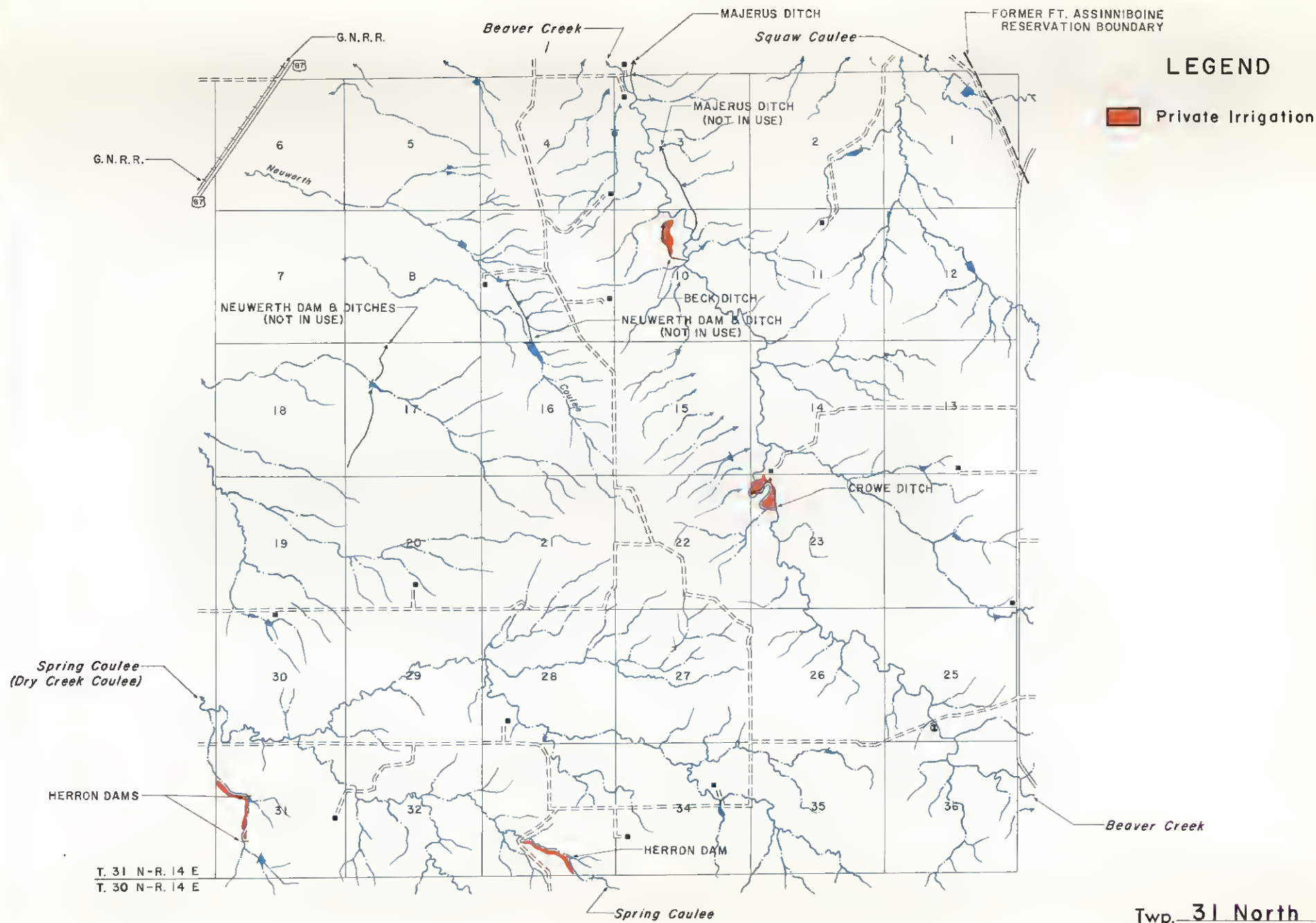


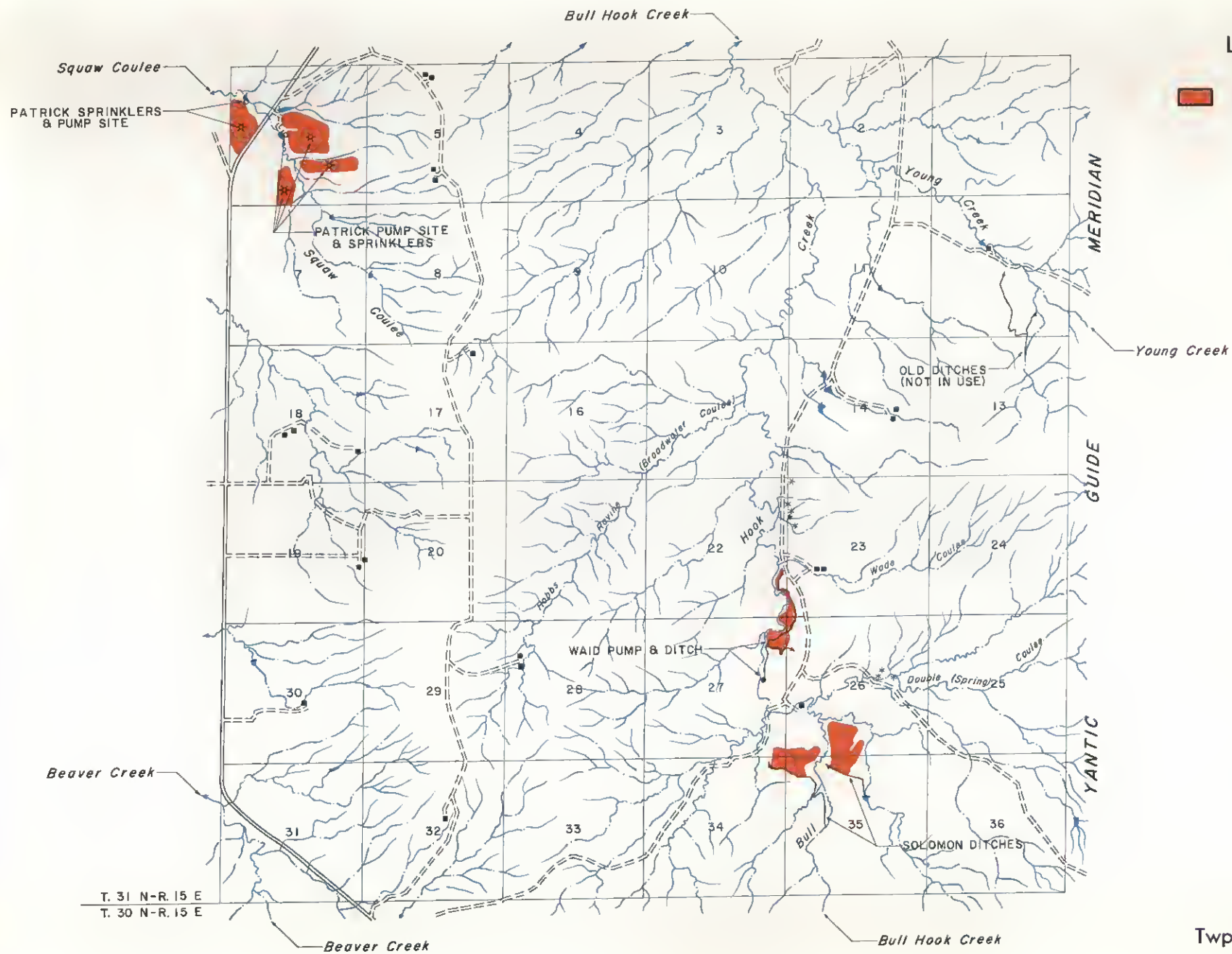
LEGEND

Private Irrigation

Twp. 31 North
Rge. 13 East





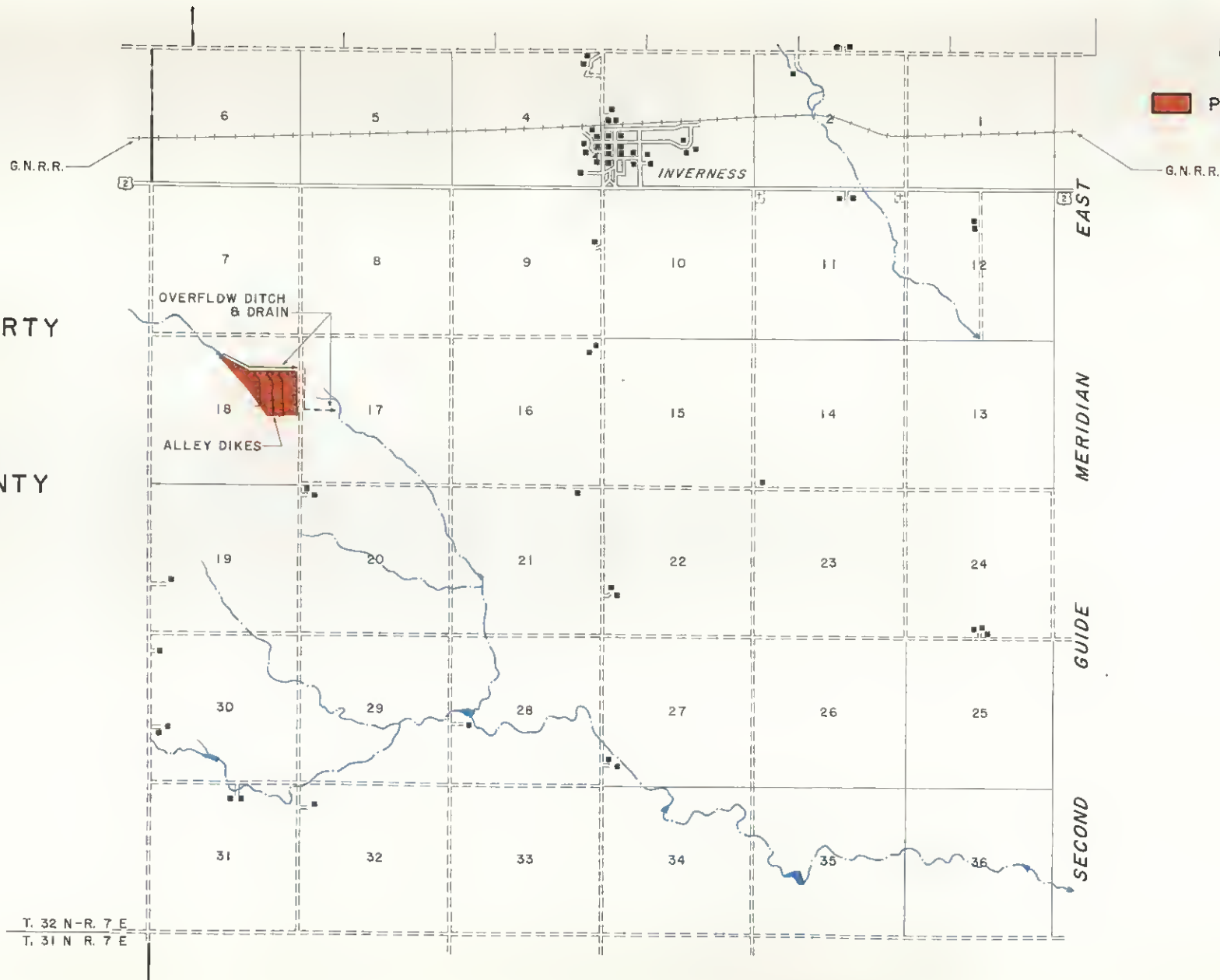


Twp. 31 North
Rge. 16 East

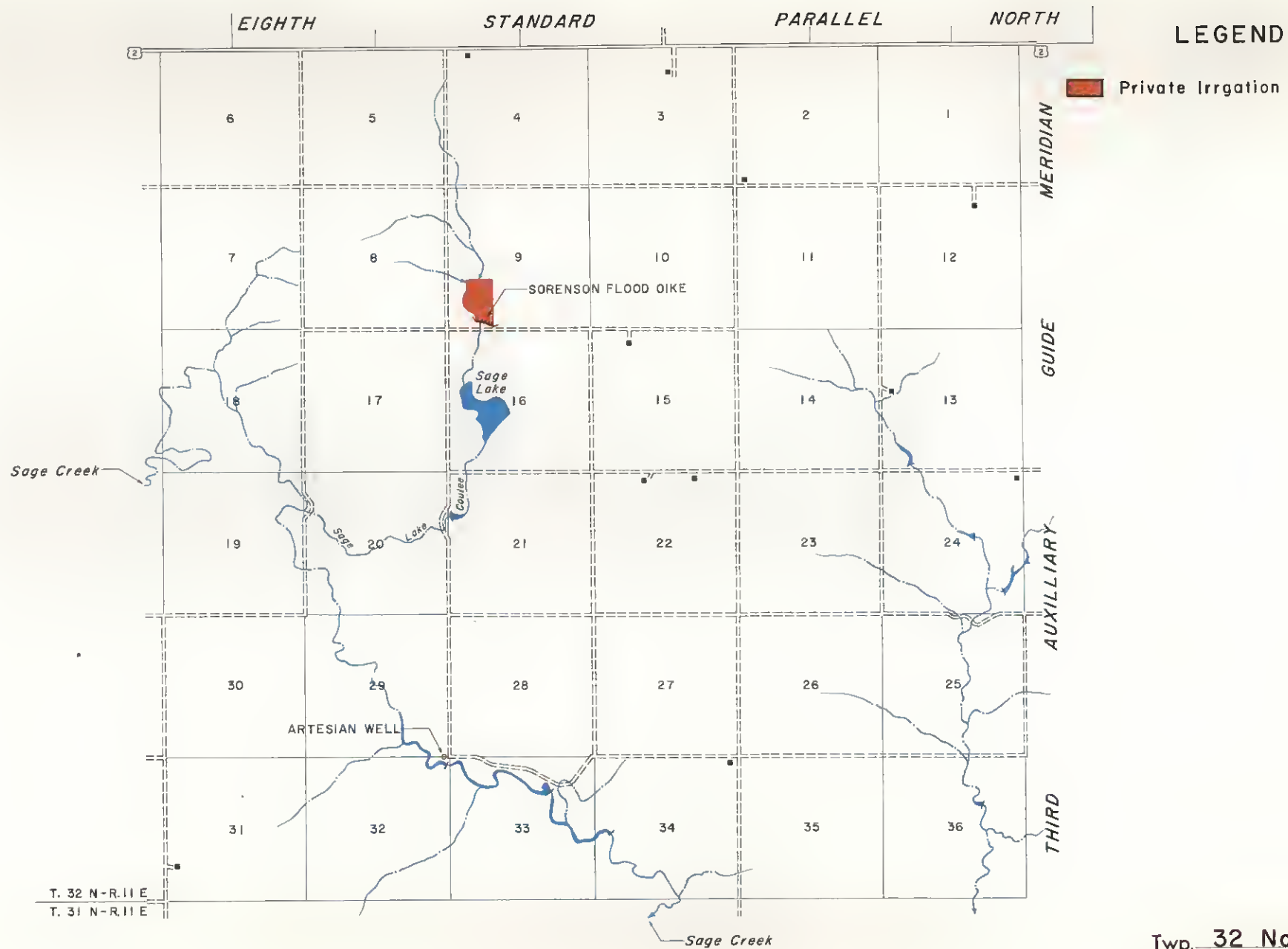
LIBERTY
COUNTY

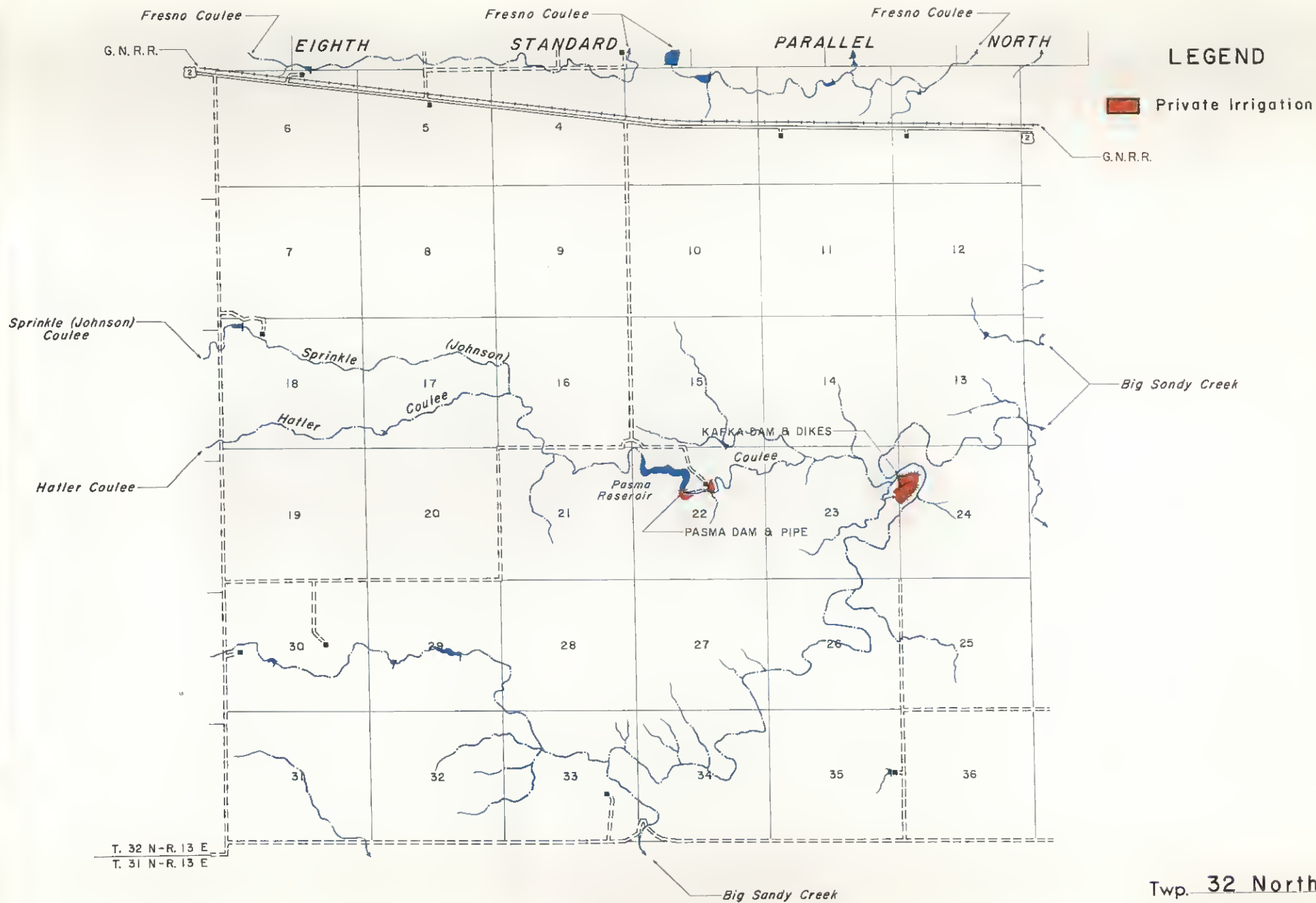
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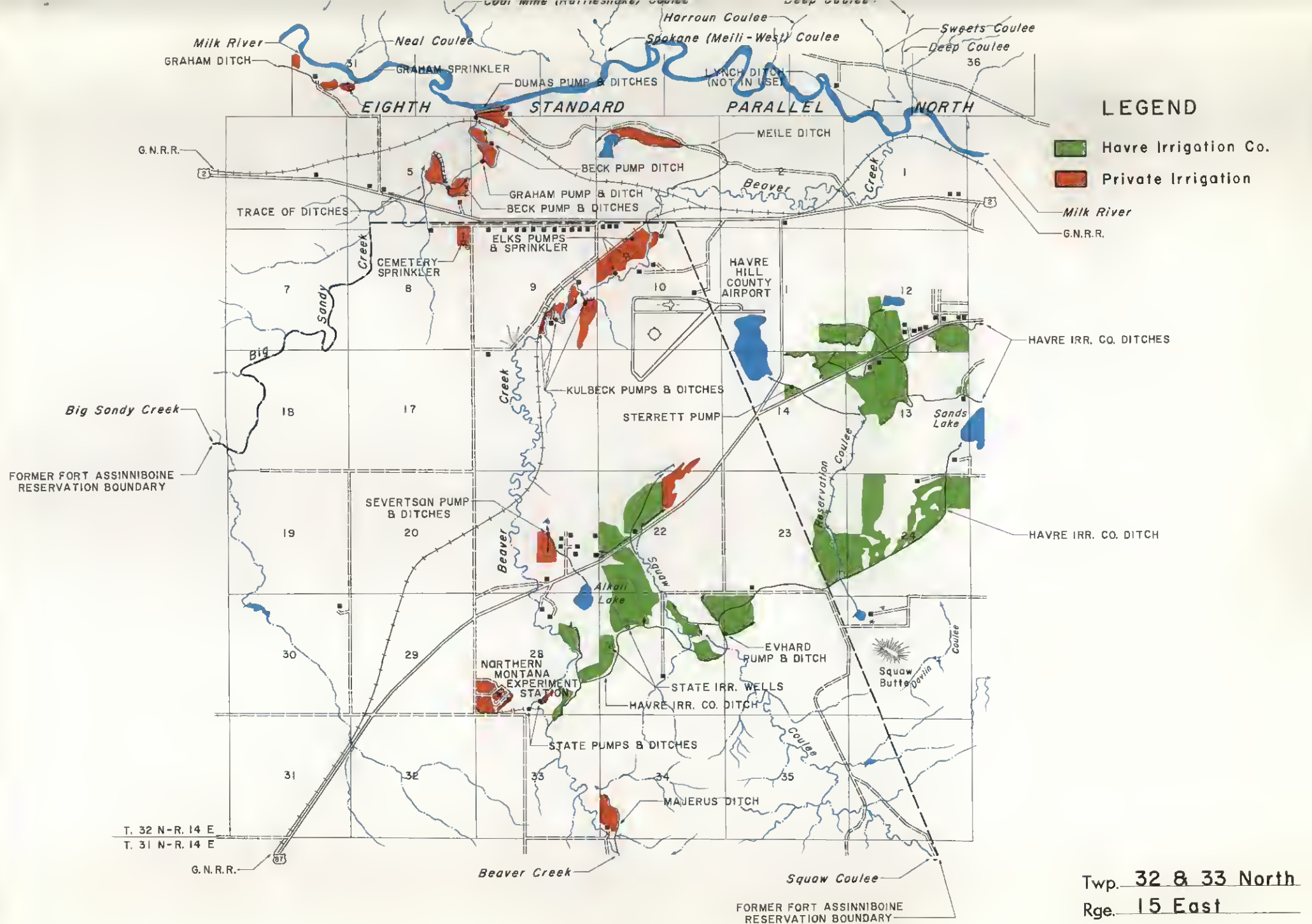
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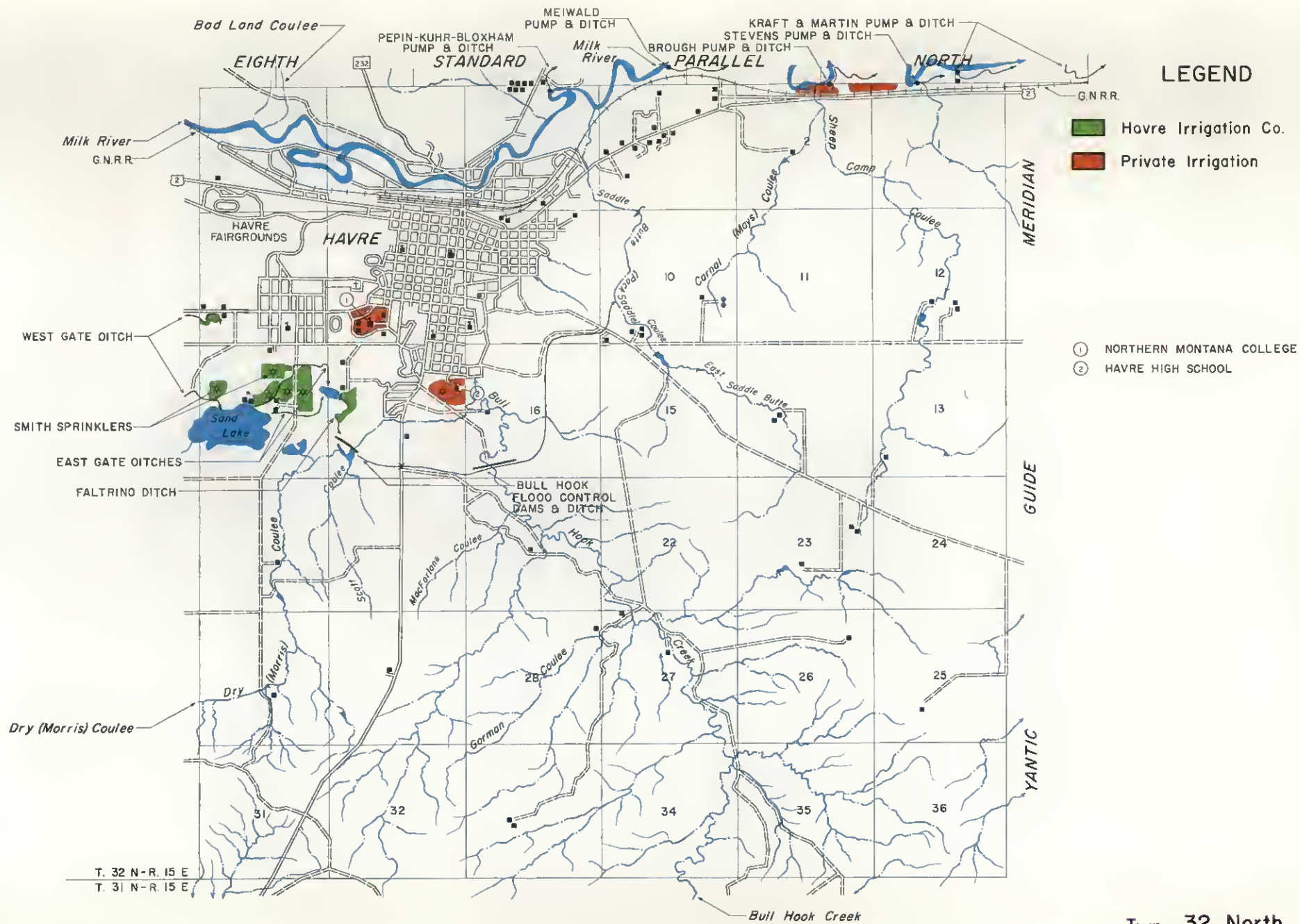


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Rge. 8 East

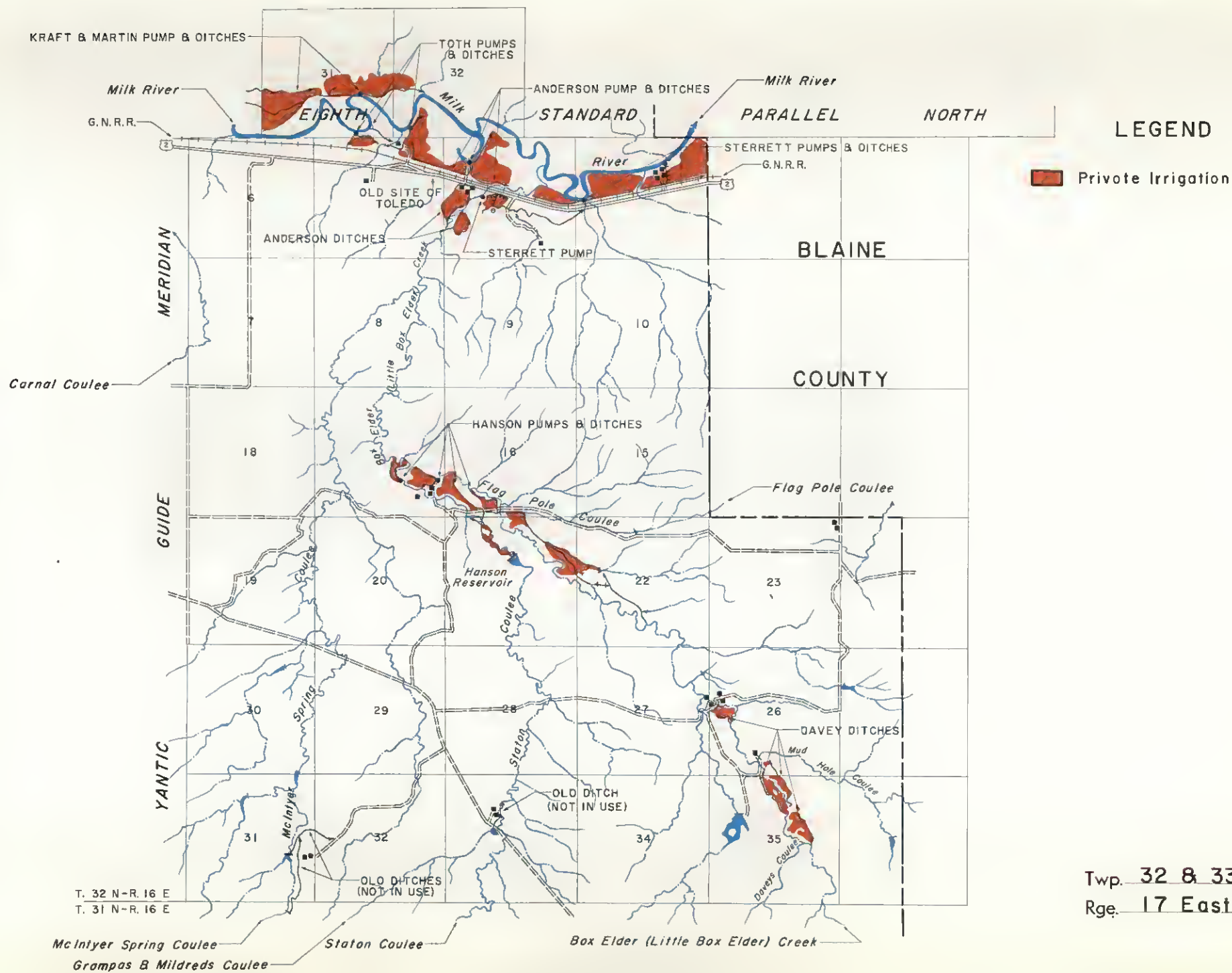




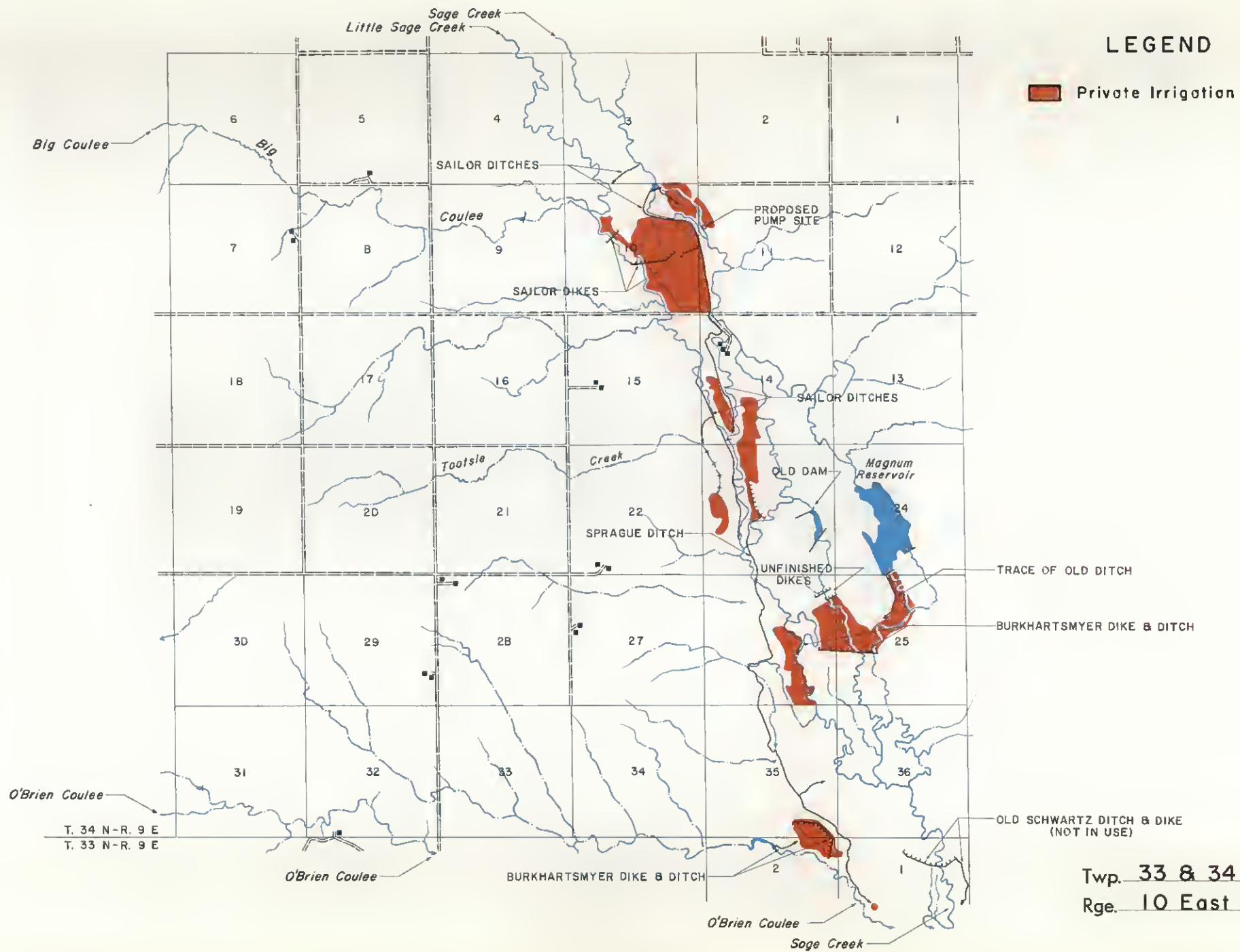


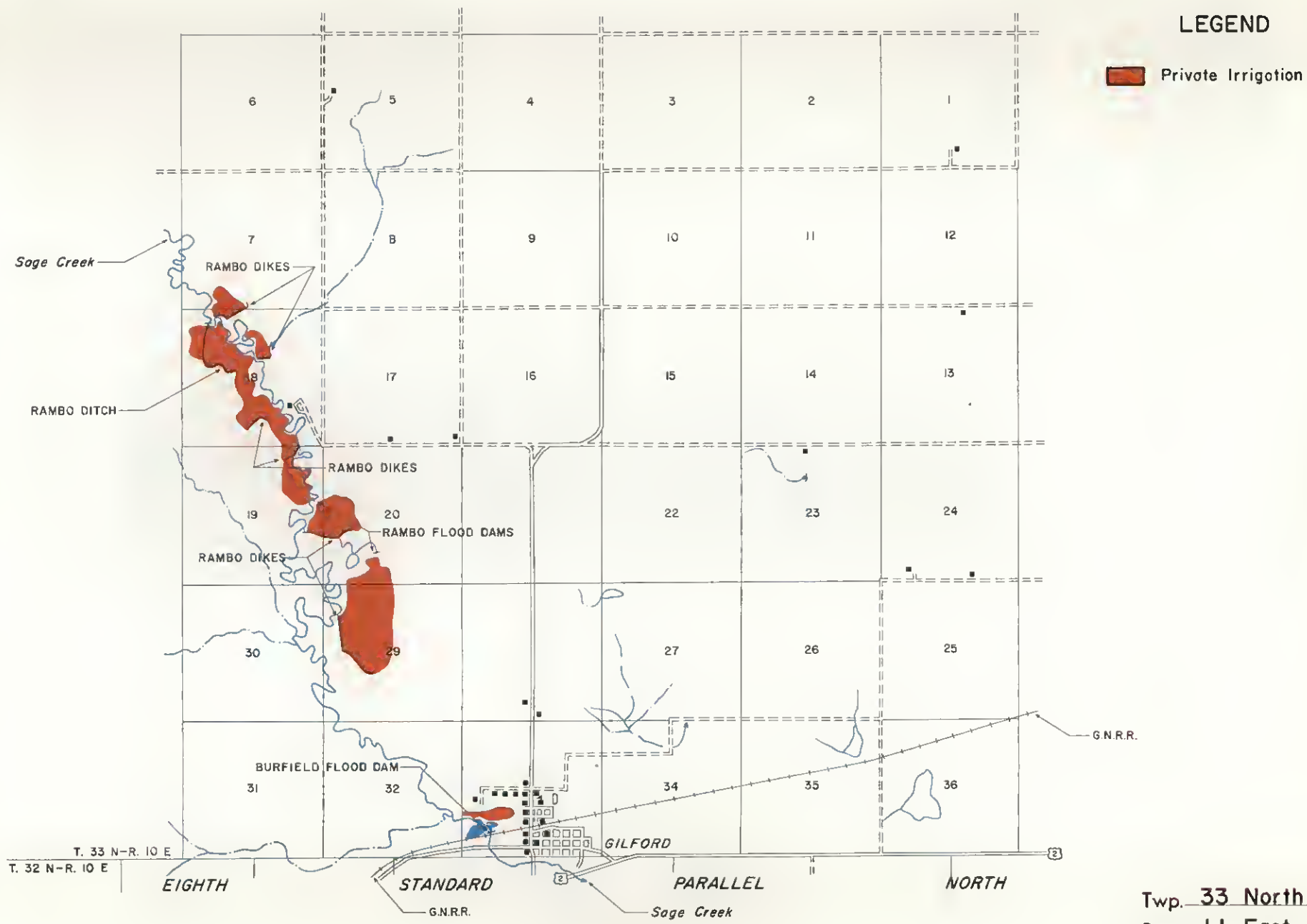


Twp. 32 North
Rge. 16 East



Twp. 32 & 33 North
Rge. 17 East

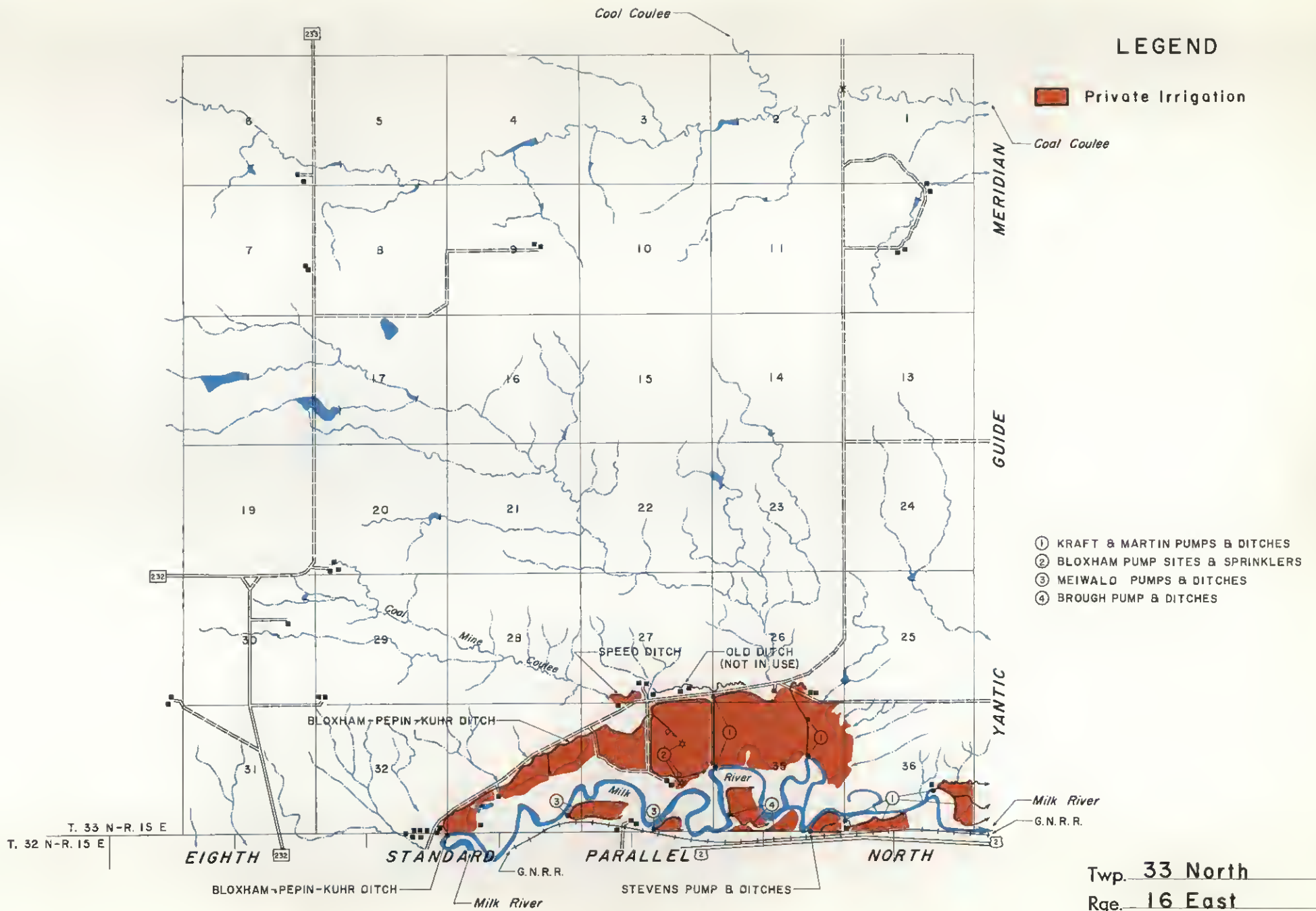


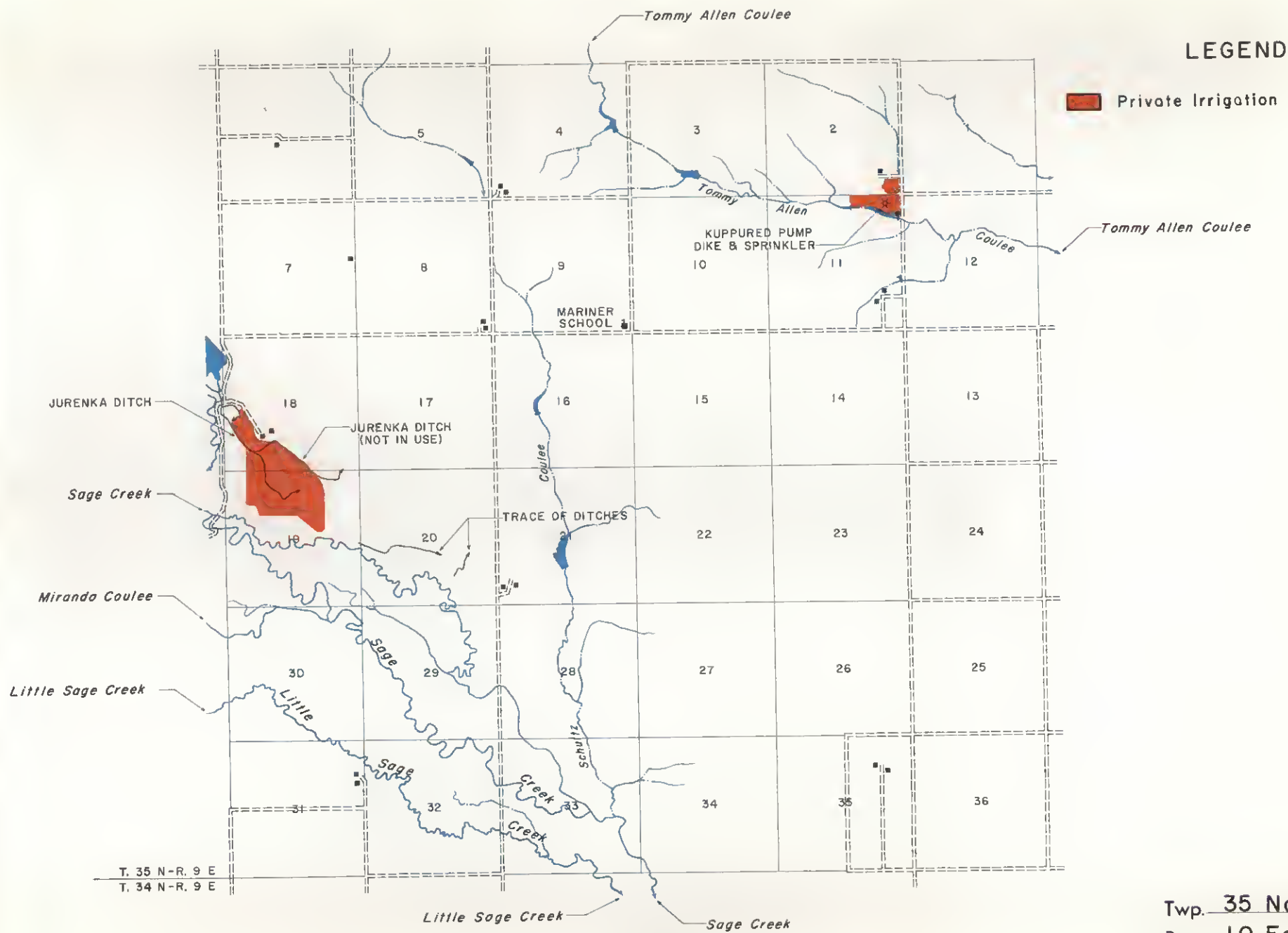


Twp. 33 North
 Rge. 11 East

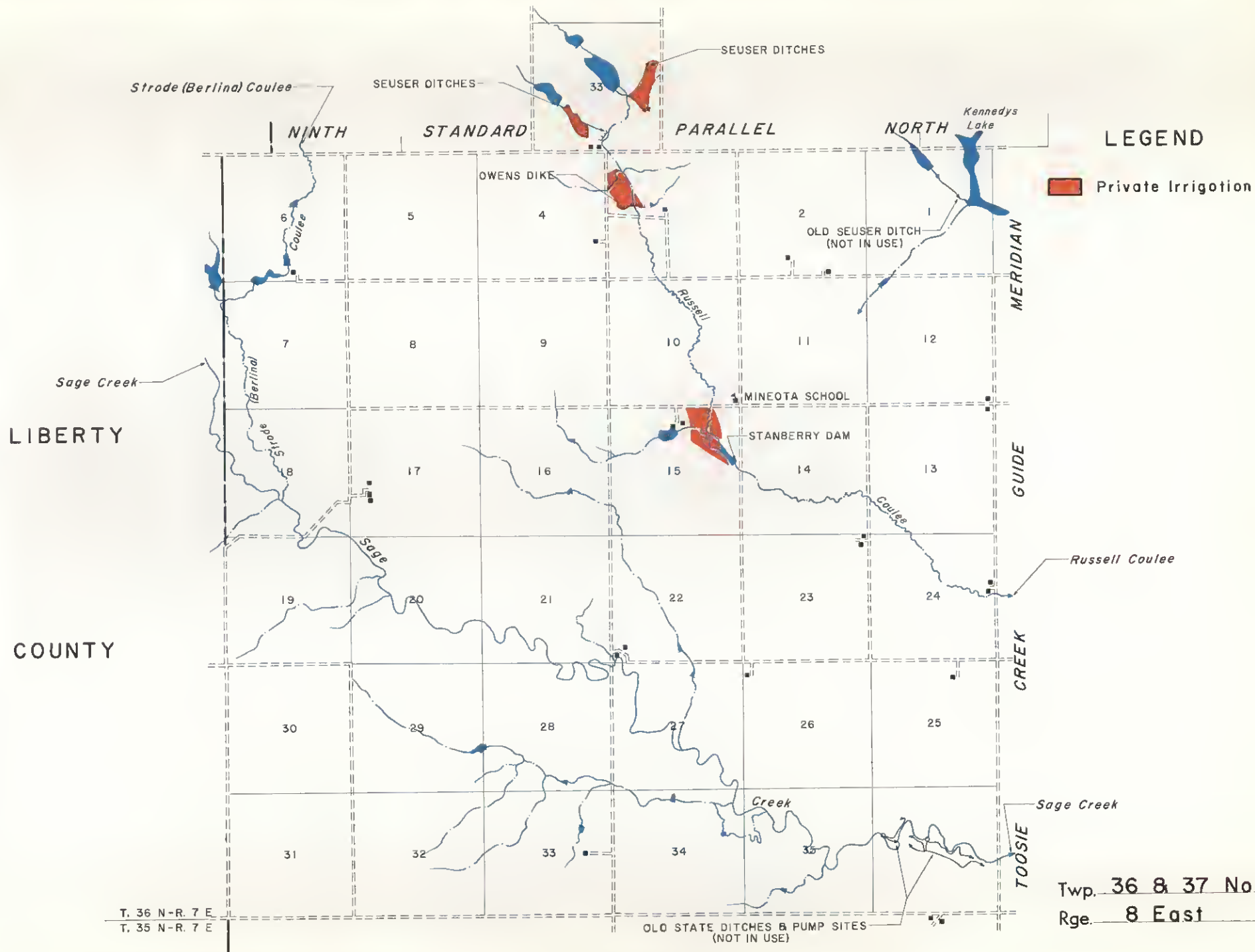


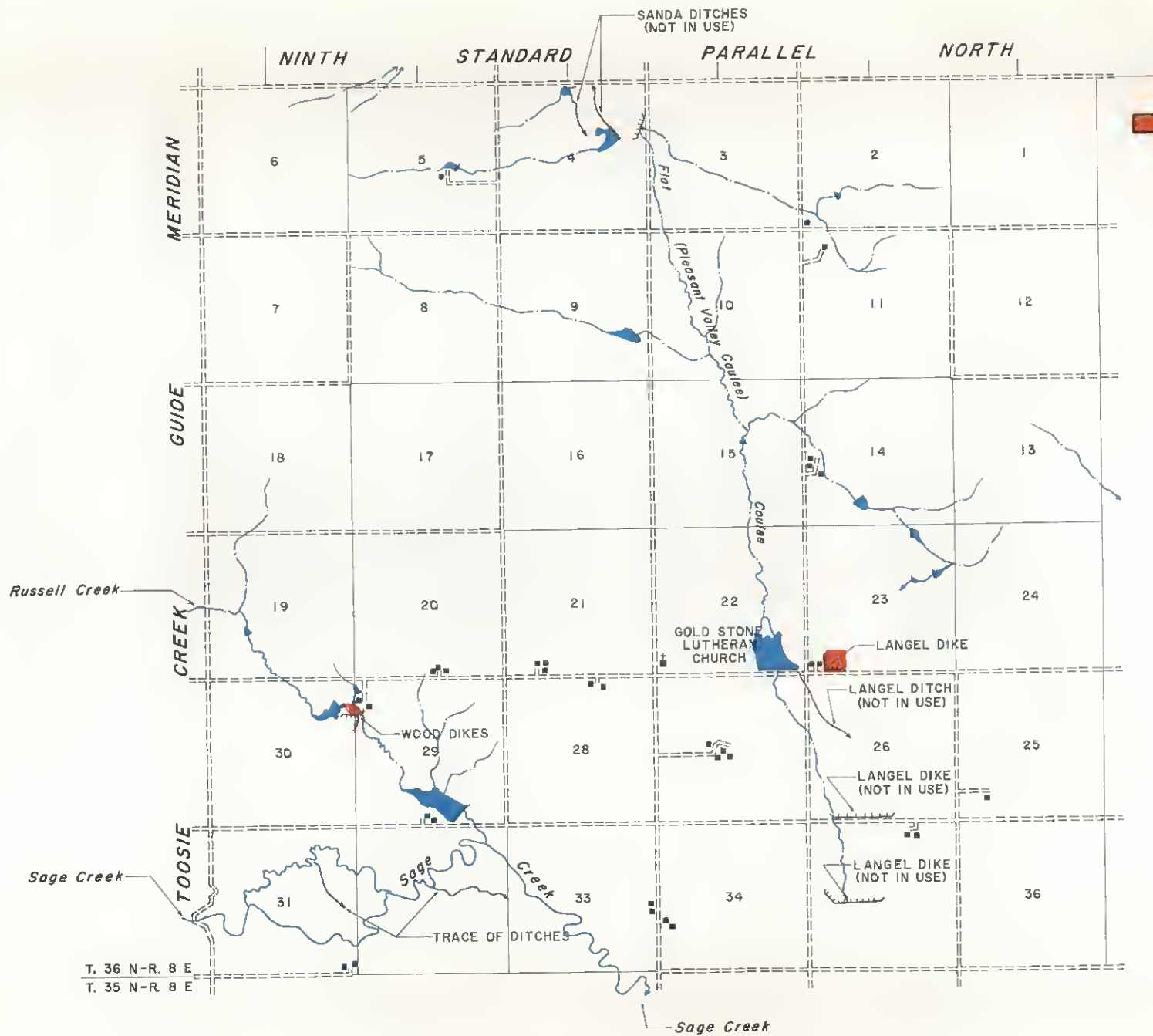
Twp. 33 North
Rge. 14 East





Twp. 35 North
Rge. 10 East



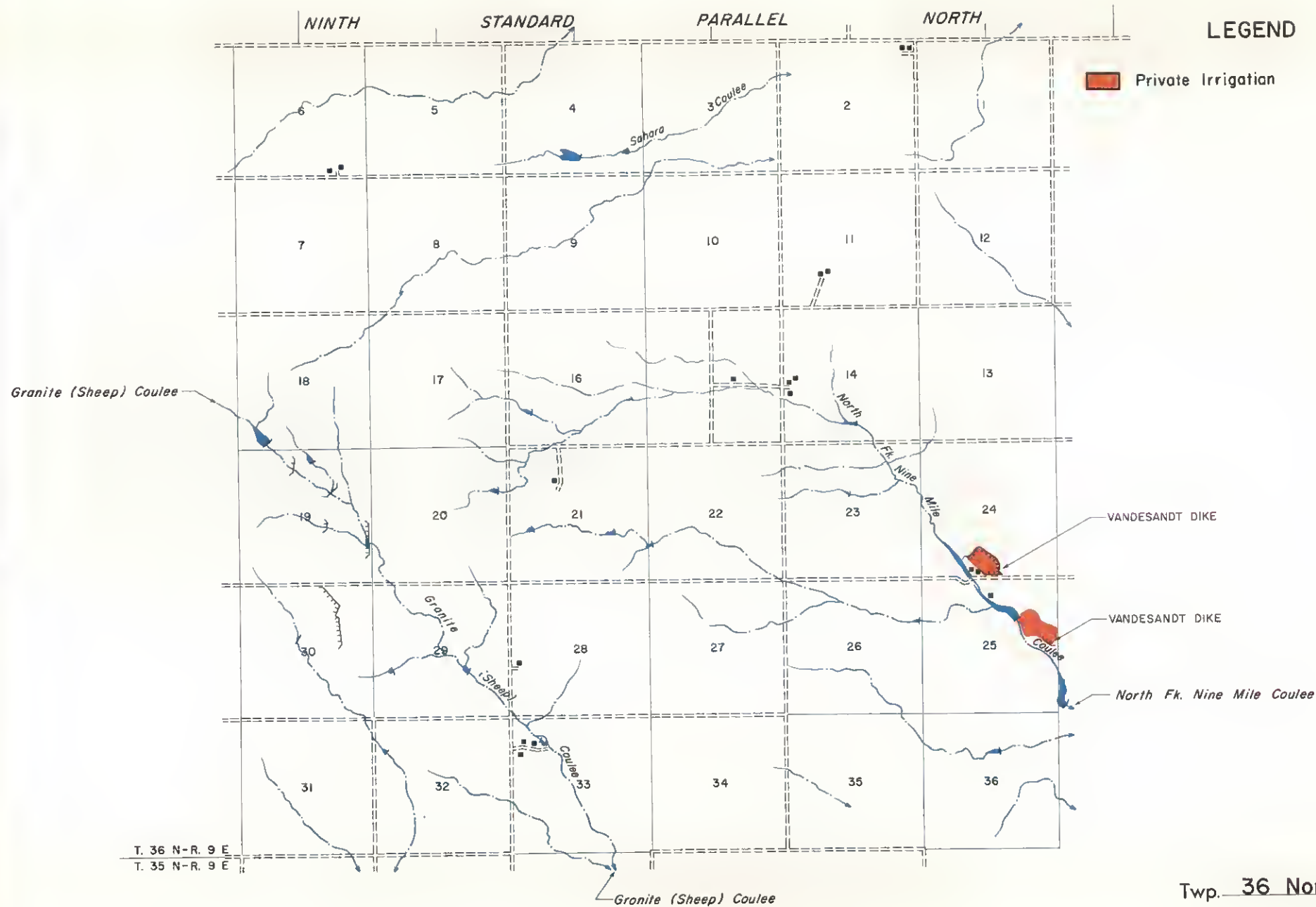


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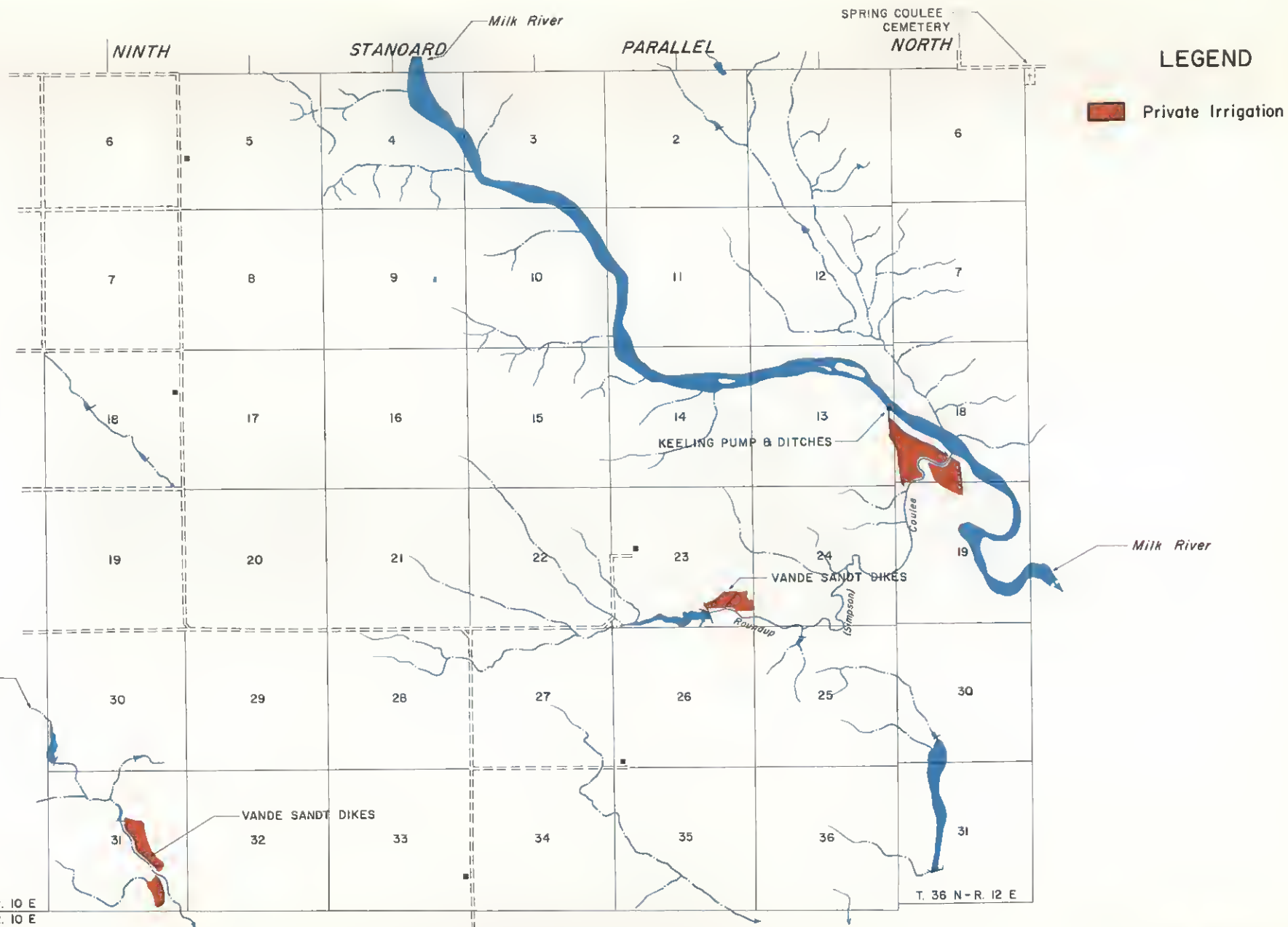


Private Irrigation

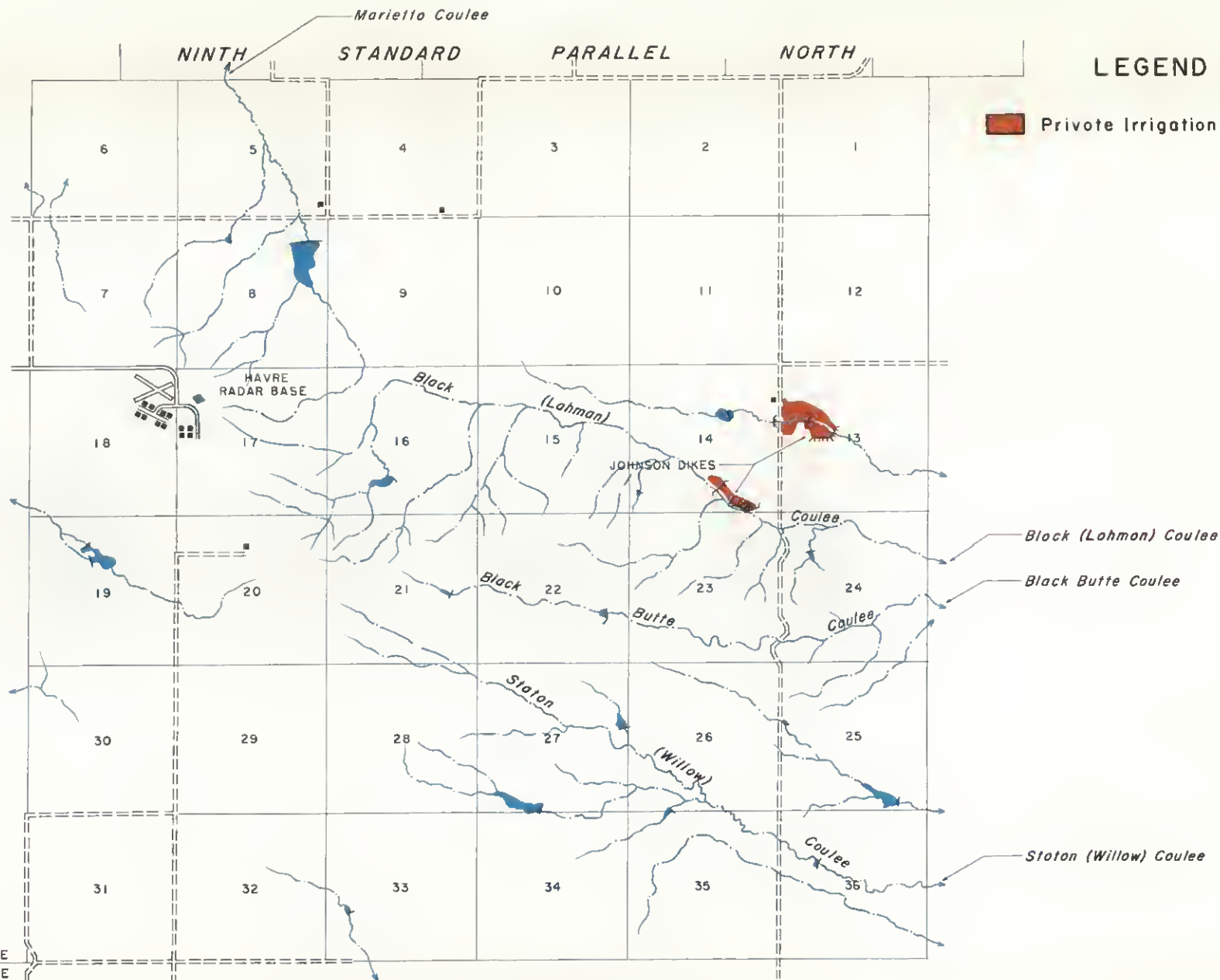
Twp. 36 North
Rge. 9 East



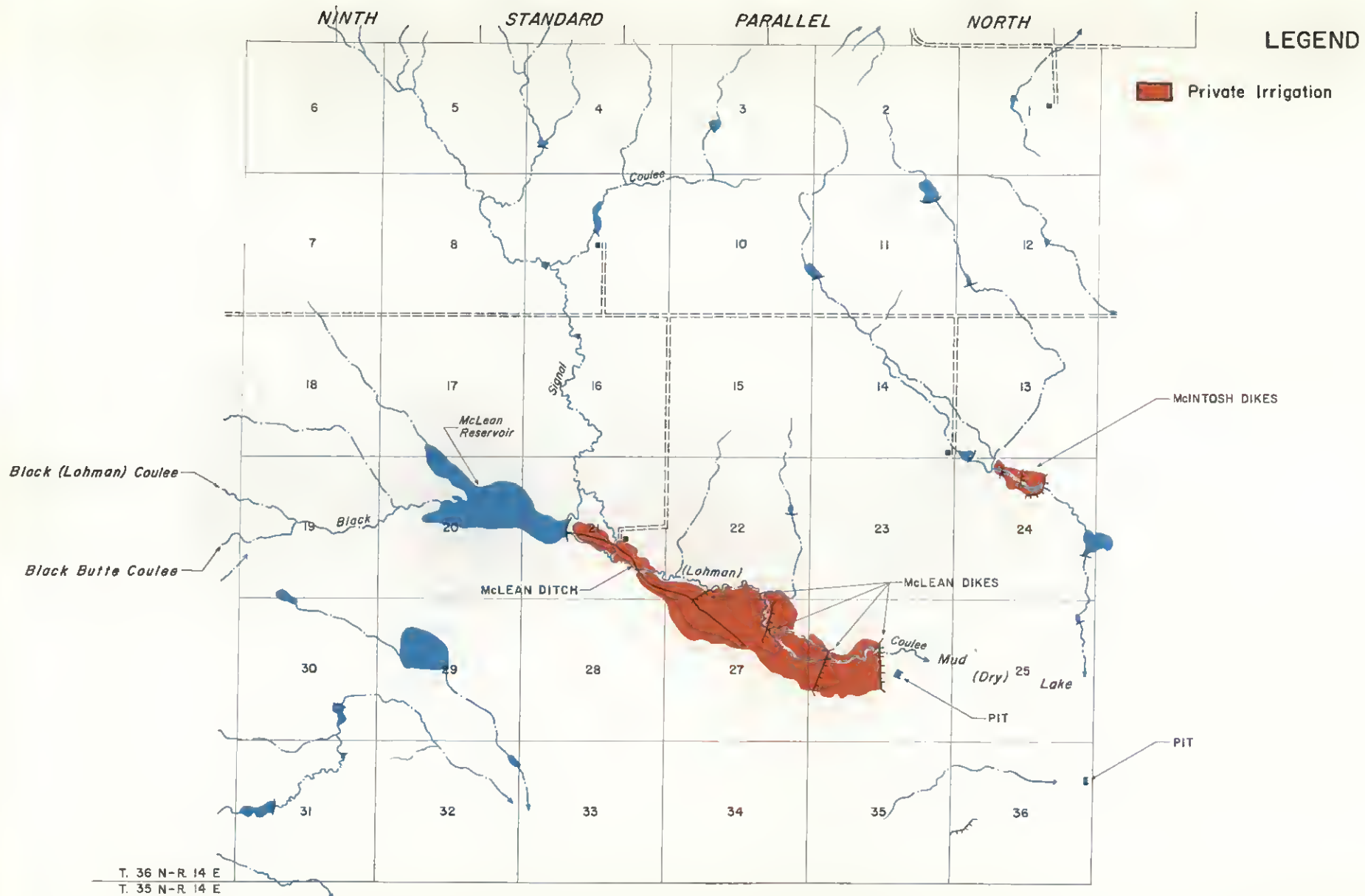
Twp. 36 North
Rge. 10 East



Twp. 36 North
 Rge. 11 & 12 East



Twp. 36 North
Rge. 14 East



ALBERTA CANADA

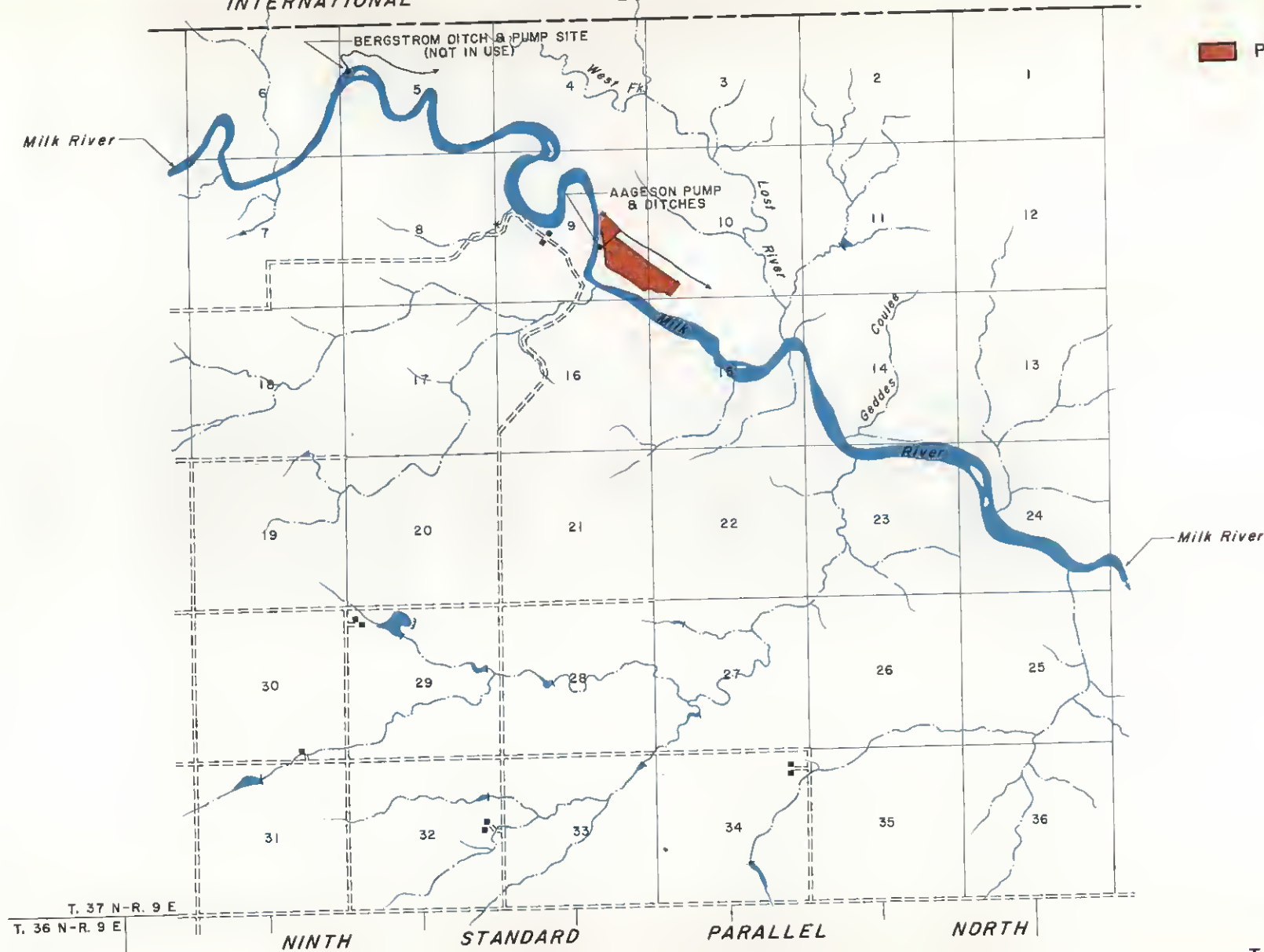
INTERNATIONAL

BOUNDARY

LINE

LEGEND

 Private Irrigation



Twp. 37 North
Rge. 10 East

ALBERTA CANADA

INTERNATIONAL

BOUNDARY

Spring Coulee

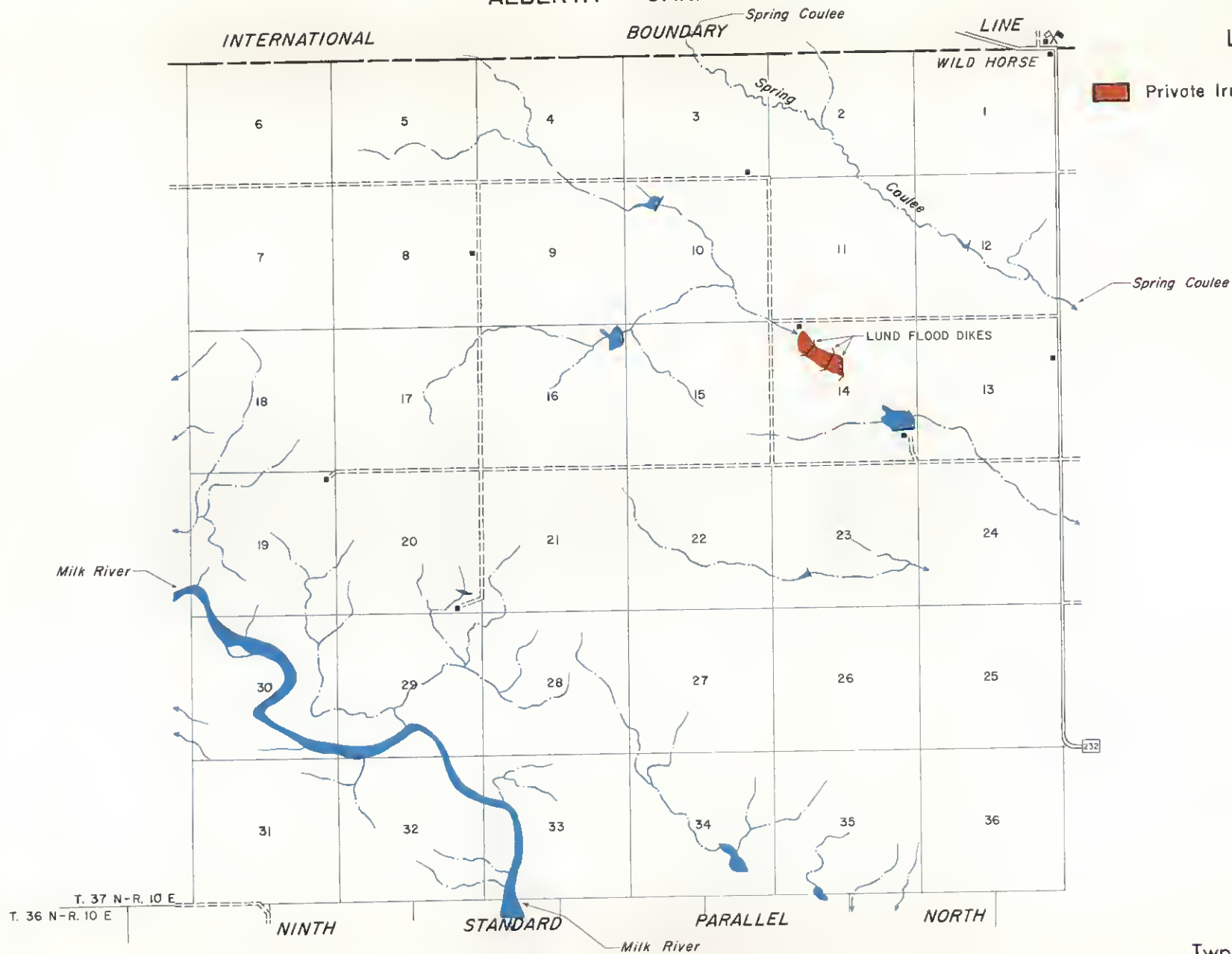
LINE

WILD HORSE

LEGEND

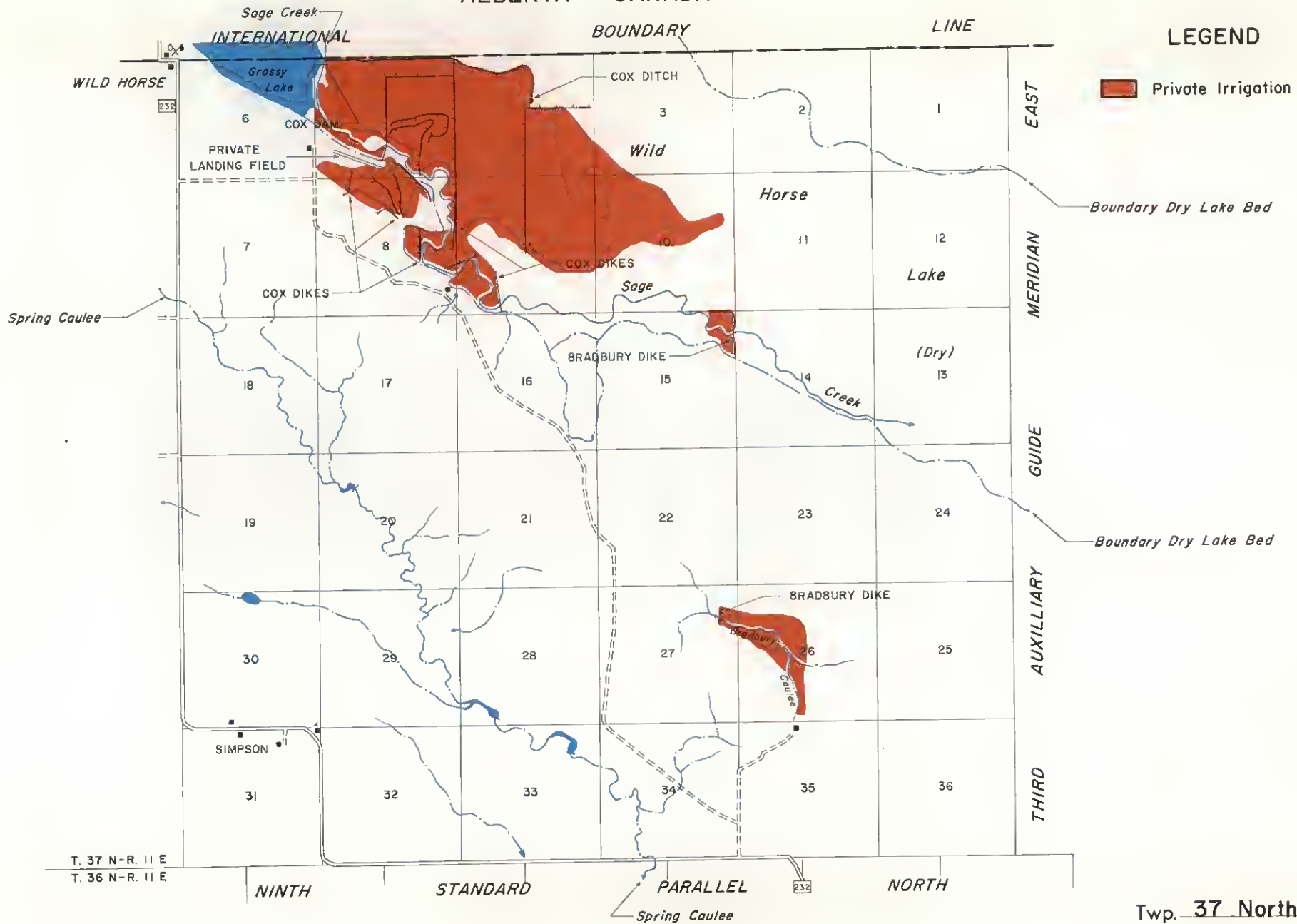


Private Irrigation



Twp. 37 North
Rge. 11 East

ALBERTA CANADA



Tw. 37 North
Rge. 12 East


SASKATCHEWAN CANADA

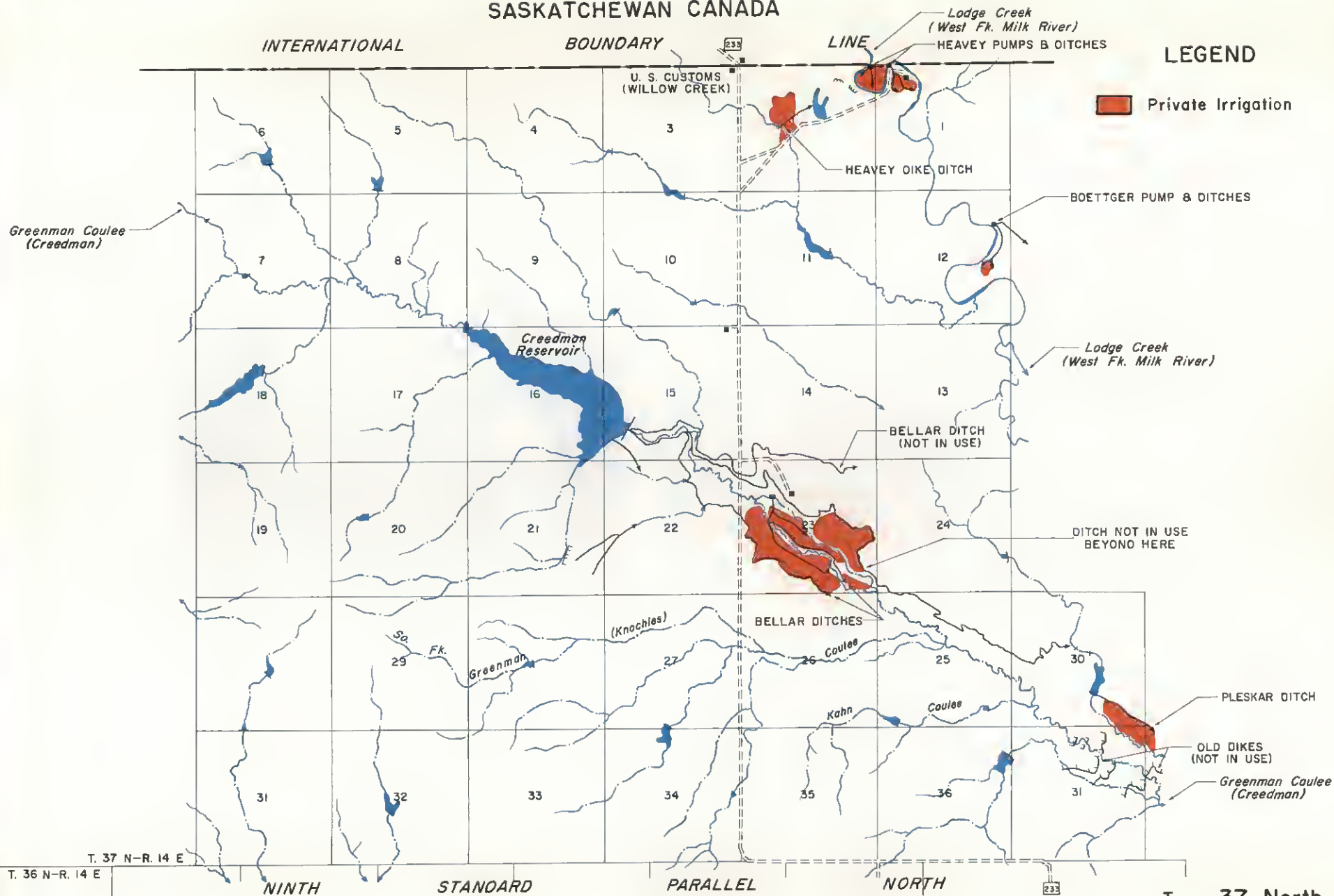
INTERNATIONAL

BOUNDARY

LINE

LEGEND

 Private Irrigation



Twp. 37 North
Rge. 15 & 16 East